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From the scientific revolution to evidence-based practice:

Teaching the short history with a long past

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Permit me to begin with my conclusions. There are two. In my view as a social worker, an academic and researcher, evidence-based practice is a high water mark in science and social work practice, and in fact, we have come a long way in a short time. And yet, there has been and will continue to be a stuttering delay between the findings of science and their application in practice.

The notion of using evidence in practice, however, is not terribly new. Imagine three cavemen. One whacks another over the head with a club because the second caveman's behavior is aberrant; knocked to the ground and in a daze, the third caveman says "Gosh! That really seemed to work. Give him another dose!" It is evidence, and the idea illustrates that decreases in symptomotology are not necessary a cure --just a decrease in some symptoms.

The issue, then, is not evidence but the probative value of that evidence. The challenge as educators is to teach students to understand how sound evidence is determined and to actually use practices for particular problems that are based on evidence with veracity. This challenge is dishearteningly formidable for a number of reasons including student's lack of understanding about research in the first place and their unfamiliarity with research's application to evaluate the effectiveness of an intervention.

There is also the daunting task of getting practitioners to change. For example, not long ago I did a workshop on mental health in the juvenile justice setting where a county-funded provider shrugged his shoulder about the research on the effectiveness of cognitive-behavioral interventions for dysthymia, and stated he didn't really believe in research, but he did believe in the retroceptive theory that depression is anger of the superego directed inward towards the ego resulting from either an intrasystemic conflict or an intersystemic conflict with the id.

Perhaps we have a more formidable task than we think.

What I will try to do in this paper is briefly illustrate what I do and would like to see done in the effort to successfully teach evidence-based practice. I will emphasis research foundations as an avenue to move evidence-based practice forward. Sometimes and with some students, these suggestions and techniques work. Sometimes they do not. They may or may not be useful to you, and all the handouts and stuff are in the public domain and may be copied *ad libitum*.

Structuring an evidence-based practice education

The first question to address in the efforts to teach evidence-based practice is where in the curriculum to introduce it and when to emphasize it. The best answer, of course, is everywhere in the curriculum.

There certainly is a critical role for evidence-base practice in the first year of the MSW. Foundation of social work practice surely should introduce evidence-based practice, including showing how to navigate websites offering systematic reviews –notably Campbell and Cochran, and frame course assignments around doing evidence-based practice. As for policy, evidence-based practice is a topic of health and mental health policy, and in a state like Oregon a state policy that actually affects social work practice in most public settings.

The field, too, has the potential to advance evidence-based practice by structuring the field placements and activities to be evidence-based (see e.g., Thomlison & Corcoran, 2007). This means having the opportunity to work with clients and to actually apply an evidence-based intervention. Those

placements that are not evidence-based should be dropped. In Oregon, having an evidence-based internship is increasingly easier as we have implemented a statute that mandates state agencies, such as Department of Human Services and the Department of Corrections, offer services that are evidence-based. The law mandates gradual implementation of at least 75% of all serves being evidence-based by the end of 2007.

The Research Foundations Course, however, is the ideal place in the foundation curriculum to introduce evidence-based practice. From the beginning of the enterprise of a research question and conceptualization to the reference list, evidence-based practice examples not only facilitates the learning and mastery of research methods, but also afford students exposure to the benefits of the exciting era of evidence-based practice. I will emphasize how I address evidence-based practice in the foundations of research course. Here are 5 things I do to introduce evidence-based practice.

Ya' know something? Understanding how we know what we know. After having taught research methods to masters students for over 25 years, I am beginning to believe that most students don't like research a whole bunch. And why should they? Research is a new way of thinking. It is sometimes complicated, and the systematic, reductionistic and linear methods that are totally foreign to the typical masters students; in the parlance of psychodynamic theory, it is ego-dystonic or ego-alien.

With this in mind, my first task is to understand these views, and to hopefully change them. I attempt to do this first by introducing students to the four general epistemologies: Authority, Tenacity, A Priori Reasoning, and Empiricism. These are summarized in Table 1. Initially I ask a student "you know something?" and the follow up questions of "oh yeah, what do you know?" and most importantly "how do you know that?"

This allows the students to appreciate different ways of knowing, and that empiricism is simply one way that is appropriate for only certain questions –and not appropriate for other questions. For example, we would not have wanted a scientific opinion survey on support for the Plessey versus Ferguson (1896) "separate but equal" doctrine to determine our policy. Only legal precedence, (i.e., authority) could give us Brown v. Board of Education of Topeka, (US, 1954; US, 1955) that would ring the bell to begin the ongoing struggle for full citizenship for all. In the Brown cases, social science along could not have changed much, but interestingly the epistemology of authority in law legally recognized (i.e. res judicata) the adverse impact of Plessey v. Ferguson (1896) based on social science (Clark & Clark, 1952).

Grasping the relativity of different epistemology, I hope but have no evidence in support, allow students to accept empiricism as a valid way of knowing when applied to proper questions. As such, this sets the stage for a more open mind in studying the foundations of research.

Historical perspectives: Pre scientific and scientific revolutions

I further attempt to introduce evidence-based practice as a recent era in the history of science, and that in fact a lot has been accomplished in the short history of science and the very short history of science and human behavior. This includes defining and contrasting the pre-scientific revolution, which emphasized how a question was answered, with the scientific revolution, which emphasizes the method of answering the question and the accuracy of the answer derived from verisimilar evidence. (See Table 2 for summary and illustration.)

We can see how dramatic this truly is by looking at medicine, which I think also helps enhance the modesty of researchers as the early pioneers in health care based their practices on observations or data, that is, evidence. They just did not do so with much accuracy (i.e., validity); however, they were consistent (reliability).

Chief among this observational approach was to watch blood dry, resulting in the theory that there are four types of bodily fluids or humors: blood, phlegm, bile, and black bile. This was consistent with the Greek quadratic world view of four seasons, four components of the environment (i.e., hot, cold, wet,

dry), four directions (north, east south and west) and four elements in the university (i.e., earth, wind, fire, and water) and so forth (Barry, 2004) . It all made perfect sense to them and it was based on "evidence."

It would be 600 years before any advance was made, which was by way of Galenic medicine (Galen, 130-200 ce). Galen did not do much, though. He simply tinkered with the Hippocratic notions, but he did so in a critically different method, "active observations". Two examples of Galen's active observation were the first dissections of animals in western science and his studies of human anatomy by treating the deep wounds of gladiators, somewhat of an approximation to human vivisections. (Ironically, as cavalier as they were about blood sports, Roman law forbade human dissections.) Galen was quite influential. His works were available in Latin, Greek and Arabic, and Galenic medicine was the "best practice" throughout the Christian and Islam worlds.

Galenic medicine was evidence-based as theory and treatment were derived from observations. With integrity, the theory of balance and imbalance in the body system (i.e., the four body humors being out of whack), produced such interventions as blood-letting, sweating, urinating, defecating, vomiting and other methods of purging to restore the balance between blood, phlegm, bile and black bile. For understandable reasons, the "best practice" soon became blooding-letting while vomiting, urinating and defecating feel into disfavor.

Both Near-Eastern and Western medicine would wait another 1,500 years before any noticeable advancement would occur. When we ask why there was so little progress for over 2000 years, at least three answers emerge. One, the Galenic theory was logical and internally consistent to the world-view at that time. Secondly, the interventions or procedures based on the theory often produced the desired results; that is, the evidence suggested they were effective, even though a patient's improvement does not prove that a therapy was effective. And thirdly, it was all that was available, and just like practitioners today, practitioners then wanted to do something to help as opposed to doing nothing.

Not until around 1550 would much advancement occur, and this was when a Flemish anatomist name Vesalius (1514-1564) did one of the first human dissections, and at about the same time Fracastorius, an astronomer and mathematician (as well as botanist and fairly good poet) concluded that Galen's observations on infra-human animals did not apply to humans. It was Fracastorius who theorized that illnesses were not the result of imbalance, but contagion from one person to another. And yet, as radical and critical as these advances were, they had very little, if any, impact on the practice of medicine for over 200 years!

Even William Harvey's delineation of the circulation of blood in 1628, which some consider to be medicine's "greatest achievement until the late 1800" (Barry, 2004, p. 21), did not have much affect on the practice at the times. Similarly, James Lind's (1753) study of the treatment of scurvy did not change practices in the British navy until 1795 -42 years after he conducted his famous "experiment." (As a side note, the study was more of single subject evaluations on an sample of 12 sailors with 2 assigned to each of 6 interventions; further illustrating that this was no experiment, the two most severe cases had as their intervention "the comfort of sea water").

If all of this is not sufficient to illustrate to students -and you- how science's impact on practice has been painfully slow, let's consider another example, the thermometer. Physicians at the "Paris Clinical," which was established Napoleon shortly after French Revolution, did not start taking a patient's temperature until the 1820s. They were the first to think it might be a good idea to monitor a patient's body temperature. The thermometer, however, was invented by Galileo sometime between 1615 and 1625 (Gribbin, 2002). Imagine that, 200 hundred years between the invention of a basic and essential medical technology and the first time it was stuck in a patient's mouth - or so I would like to assume its first application was from that direction.

A paradigm shift away from paradigm shifts . As part of this historical wide-angle lens, I also attempt to tackle the mighty Thomas Kuhn (1970) and debunk the "paradigm shift" notion that science advances when old methods prove inadequate and are replaced with a new paradigm. I find this

particularly important for MSW students because almost every time they reject something probatively established, such as evidence-based practice, they proclaim "a paradigm shift."

The limitation of the Kuhnian view is illustrated with the "revolutionary" change with Copernicus' heliocentric view of the universe which replaced Ptolemaic earth-centric view. I point out how this was not a revolution that emerged out of thin air, as Copernicus simply got the historic glory after having built upon the published work of Johannes Mueller (aka, Regionmontanus) in 496. Mueller was himself greatly influenced by his teacher, Georg Peuerback who started translating Ptolemy into Latin from Arabic, and Mueller finished the translation by pointing out distinctions from Ptolemy, namely the heliocentric view. This revolution was, in fact, evolutionary.

I point out that major leaps in the development of science occur, such as Newton, whose ideas did seem to come out of pure air, and Florence Nightingale's development of the pie chart, Einstein's theory of relativity, Skinner's reinforcement schedules and operant conditioning, Bandura's self efficacy research, and Corcoran and Fischer's advances in clinical measurement (I had to throw that in somewhere!). The point to be made is the fact that the history of science is not a revolution but an evolution that builds on a foundation of facts and theory. Evidence-based practice, in my opinion, is just part of this evolution.

In summary, I think it helps students to master research and evidence-based practice by realizing the scientific revolution is not even 500 years old (2006 – 1543), --a fairly limited span in human history. In contrast, it was more than 2,000 years between the time of Hippocrates (born around 460 bce) and the introduction of science into medicine. Two thousand years certainly is a long time!

As for human behavior and science, this history is only 127 years old, dating from the establishment of Wunt's research laboratory in 1879 (see Figure 1). And yet, here we are in our own renaissance, a new renaissance in practice: the "era of evidence-based practice" –though some might call it the "error of evidence-based practice."

In summary, as a lesson in history, I must admit all too often students have distaste for history almost as strong as their distaste for science. That having been said and be that as it may, I do it anyway knowing that a final exam always heightens attentiveness. An exams also evidence the role of religion in research; to paraphrase the Revenant Jessie Jackson, as long as there are exams in a classroom, there will be prayer in the classroom.

Research methods are another content area to introduce evidence-based practice. The typical Campbell and Stanley discussion may be illustrated with examples from the evidence-based practice literature. The methods content may be organized round an evidence-based practice model.

With single subject research designs, I have the students make clinical observations with a rapid assessment tool in a simple AB design which are relevant to evidence-based practice. More advanced designs, ones that may actually be rigorous enough to be considered "evidence," are illustrated with the very first systematic single case study in American history, namely Ben Franklin who evaluated his development of his 13 virtues (see Table 3). It makes a good group assignment to have the students try to develop a design to evaluate the implementation of 13 different variables. (Hint: it was a multiple baseline design lasting 52 weeks.)

I attempt to illustrate two research designs and evidence-based practice with mock research summaries, an idea I shamelessly "borrowed" from Geraldine Macdonald. One design is quasi experimental providing weak support for client centered therapy (Table 4), and the other is a RCT using ECT with strong evidence supporting its effectiveness (Table 5). In small groups, half get the quasi-experimental study and the other half get the RCT, and are instructed to critique the research from an evidence-based practice perspective. After discussing the summary, each group presents their critique. As you might expect, the groups typically praise the client centered approach, finding practical value and have strong criticisms for the RCT and how revolted they are about the ECT treatment. (Don't that beat all! It is an eye-opener to students, too.)

Measurement and psychometrics materials are additional fertile ground for introducing evidence-based practice. This is chiefly by using illustrations of sound outcomes measurements and having students make systematic observations of a clinical variable.

In this portion of the course I find it noteworthy to point out that written measurements have had a history dating back 5,000 years before the creation of the written word, and that advances in every field have followed advances in the measurement of "things" (e.g., constructs and concepts) in that field. Before anything can be studied, that "thing" has to be consistently and accurately measured. By this point in the course, however, they are tired of mini-lessons in history and merely nod their head dutifully with eyes a glazed.

Finally, evidence-based practice is itself a topic of research. It ties together the entire research enterprise covered in a foundation course. In particular, but using evidence-based practices derived from systematic reviews as a concluding topic students are re-exposed to many research topics. Even the very basis of an effect size re-exposes students to the normal distribution, experimental and control groups, research designs, variables and measurement and so much more. And of course, the ultimate outcome is access to practice protocols which students actually use to help a client change.

After the foundations of research, evidence-based practice courses should be available for all types of social work practice with all sorts of clients. Admittedly, this is an easier task of clinical social work with adults than community organization, for example. Finally, these courses should be required and not offered as mere electives, and those practice courses where the content is not evidenced should be struck from the curriculum. Let me repeat that, all practice courses should be evaluated by the degree to which they are evidence-based, and those with none or non-supporting evidence should be eliminated from the curriculum; that's my opinion and I'm sticking to it!

Conclusions

These are the primary suggestions I have for teaching evidence-based practice. It is illustrated to my students, and hopefully to you, that science had a slow start in western history. And yet, here we are today: with sufficient reason to be proud, we are in an era when having evidence-based practices is a reality. As Ebbinghaus commended (which you may have forgotten because of the curve of retention), research in human behavior is a short history with a long past (cite in Chaplin & Krawiec, 1960). Science really hasn't been around that long and neither has the study of human behavior. So when combined, the relationship of science in social work practice has been a short history with a long past.

In this short history we have come to a point where it is plausible to demand that practice be evidence-based. The very fact that the research is there is quite an accomplishment, especially if you take the long view of things. In essence, we have come a long way in the past 127 years in the development of evidence-based practices. However, we must remember that history has shown that just because the science is there does not mean it will be used immediately. Evidence-based practice will likely be similar to other scientific advances: it may take longer than we think to get practitioners to use the science. So we must start now, and hopefully this symposium will facilitate the use of evidence-based practices in social work. Patience is important, though. Perhaps, Alfred Lord Tennyson said it best:

"Science moves,
but slowly,
creepy
from point
to point."

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Table 1
How we know what we know: epistemologies

Epistemology: The philosophic inquiry into nature of knowledge, that is"truth." Or how do you know what you do know to be "true?"

4 Epistemologies	Examples
1. **Tenacity**: accept X as true because it has always been accepted as true.	Traditions, Stereotypes
2. **Authority**: accept X as true because someone said it is so.	Religions doctrines Legal precidents/judges
3. ***A priori*** reasoning: intuition and pure reasoning.	Descartes, "I think, therefore I am, (I hope).
4 **Empiricism**: orderly universe, natural Y have natural X, knowledge is demonstrative, knowledge is derived from human experience, humans can understand.	Evidence-based practice

Table 2.

Summary of Pre-scientific revolution and the scientific revolution*

For convenience, most historians of science date the beginning of the scientific revolution with the publication of Copernicus's On the revolution of celestial bodies and Andreas Vesalius's On the structure of the human body, which coincidentally occurred in 1543.

The scientific revolution is characterized by improved methods where the accuracy of the answer was more important than the way by which one thought things out, which was the defining feature of the pre-scientific philosophers. Prior to this dramatic change in how we viewed the way knowledge is ascertained, methods of answering questions were more important than accuracy of the answer (Dear, 2001).

Here is an illustration. One of the authors, Corcoran, had a roommate in college, Ernie Lidquest, who complained that he ran out of marijuana before his monthly allowance arrived from home to purchase more. Corcoran informed Ernie that the problem was not that he was smoking too much marijuana, which he was, but that he was defining the problem incorrectly. If instead of smoking all his marijuana, all Ernie needed to do in order not to run out was to simply smoke half of it first; once that was gone, all he had to do was smoke half of what was left; and then half of that, and so on. Since all space is infinitely divisible, an axiom Corcoran and Lidquest had just learned in their "math appreciation" course, if Ernie would just follow Corcoran's advance, he would always have some marijuana left and, therefore, would never run out! Ernie, being under the influence of marijuana at the time, thought this was an excellent idea and was grateful for the pre-scientific methodology –until, that is, he ran out of marijuana a couple of days later.

In contrast to how the question was asked, the scientific approach changed the method of answering the question. This, in turn, improved the soundness of the methods in order to increase the likelihood of more accurate observations. The improved methods tended to provide more persuasive evidence as the observations were more objective and not as greatly influenced by the method of asking the question. Ernie would have been better served with the objective observations that he should smoke less, buy cheaper marijuana, or get an increase in his allowance.

*(Abstracted from Thomlison and Corcoran, 2007).

Table 3
Ben Franklin's 13 Virtues and America' first single subject design

Assignment: Below are the 13 virtues of Benjamin Franklin. How would you develop these virtues in yourself? Develop the best possible, but feasible, single system design to be used in developing and monitoring the development of these virtues.

1. Temperance, eat not to dullness. Drink not to elevation.
2. Silence, speak not but what may benefit others or yourself. Avoid trifling conversations.
3. Order, let all your things have their place. Let each part of your business have it time.
4. Resolution, resolve to perform that you ought. Perform without failing what you resolve.
5. Frugality, make no expense but to do good to others or yourself; waste nothing.
6. Industry, lose no time. Be always employed in something useful. Cut of fall unnecessary actions.
7. Sincerity, use no hurtful deceit. Think innocently and justly; and if you speak, speak accordingly.
8. Justice, wrong none, by doing injuries or omitting the benefits that are your duty.
9. Moderation, avoid extremes. Forbear resenting injuries so much as you think the deserve.
10. Cleanliness, tolerate no uncleanness in body, clothes and habitation.
11. Tranquility, be not disturbed at trifles, or at accidents common or unavoidable.
12. Chastity, rarely use venery but for health or offspring; never to dullness, weakness or the injury of your own or another's peace and reputation.
13. Humility, imitate Jesus and Socrates.

Table 4. "The impact of client-centered skills and psychotherapy" The Clinical Counselor, 1, 1-9

Introduction

The author reviews the literature from Roger's original 1957 article that avers that there are five "necessary and sufficient" conditions for change in psychotherapy, which includes warmth, empathy and genuineness. The author thoroughly referenced seminal literature, including On becoming a person (1961), and the research by Truax and Carkhuff on training in warmth, empathy and genuineness. The author was particularly interested in empathy, stating "the purpose of this study was to determine the impact of empathy on subjects' perception of psychotherapy. It was hypothesized that those patients who perceived their psychotherapist as empathic would report more bonding with the therapist, and that the more empathic therapist would also report more bonding with those patient with whom he/she was more empathic."

Methodology

Research participants were recruited from an introductory psychology course at a private Christian college in the Midwest who volunteered to participate in research projects for course credit. 50 students volunteered and the researcher randomly selected 30 participants. Half were from a morning section of the course and the other half were from an evening section. The researcher reported all relevant demographic data, such as the average age (20 years of age) and that all were females.

Procedures and design. The researcher used a quasi-experimental design with a pre-test and post-test. Each research participant was exposed to 6 15-minute interviews twice a week for three weeks with a first year masters of counseling student (i.e., the low empathy condition) and a Ph.D. level supervisor from the college counseling center (i.e., the high empathy condition). The decision of which section received the high or low empathy condition, which was the independent variable, by a flip of a coin, with the morning section exposed to the high empathy condition.

The dependent variable was scores on a 4-item therapeutic alignment scale, which asserted the magnitude of bonding as experienced by a client for his/her psychotherapist or a therapist's experience of bonding with a client. Research participants completed the instrument in the waiting room before the first interview and immediately after the 3rd interview. The low and high empathic therapists completed the bonding scale only at the post test.

Results and Discussion

The author stated "the pre-test scores were substantially lower for both the high and low empathy condition at the post-test, such that the patients improved on bonding after the 3rd session of therapy. The finding occurred for both the low and high empathy psychotherapists. The therapist's post test scores on bonding with the patients were not correlated with pre-test or post-test bonding scores extracted from the patients. …..

The pre-test post test change clearly supports the value of empathy in psychotherapy. Moreover, since the improved therapy outcomes were found for both high and low conditions of empathy, these finding are encouraging for even the inexperienced psychotherapist learning his or her trade. The implications are clear, psychotherapists –inexperienced or experienced—are well advised to be empathic in order to establish therapeutic bonding."

Group assignment: assess the value of this study. Does it give you useful results for practice? What are the strengths and limitations of the research that impacts upon the usefulness of the study?

Table 4. "The impact of ECT on major depression in female inpatients, Psychiatry, 121, 1-9

Introduction

The author reviews the literature on electroconvulsive therapy (ECT) since von Meduna's (1934) claimed that pharmacologically induced seizures successful treated catatonia and schizophrenic symptoms and Cerletti and Bini administration electro-induced seizures. The author thoroughly references seminal literature, including the electrophysiology of neurons which tend to be in a resting state but shocked into having a large number of neuron fire in unison. While the research has supported the conclusion that ECT is effective with major depression, especially for the elderly, the author was particularly interested in ECT for major depression in youth patients, stating "the purpose of this study was to determine the impact of ECT on subjects' self-reported levels of depression. It was hypothesized that those patients who received 6 sessions administered twice a week for three weeks would report less depression compared to patients randomly assigned to a no-treatment control."

Methodology

Research participants were recruited from a private psychiatric hospital in the Midwest, which had a 50-bed unit for patients with major depression. The 50 patients all volunteered to participant in the research study, and 30 were randomly selected. Of these 30 patients, 15 were randomly assigned to received the ECT condition and 15 were in the control group. The researcher reported all relevant demographic data, such as the average age (20 years of age) and that all were females.

Procedures and design. The researcher used a RCT with pre-test and post-test assessments. Each research participant was exposed to 6 15-minute ECT sessions administered twice a week for three weeks. The ECT was the independent variable with two levels, one receiving ECT and a no-treatment control. Assignment to the conditions was determined by a flip of a coin.

The dependent variable was scores on a 4-item depression scale, which asserted the magnitude of four symptoms. Research participants completed the instrument in the preparation room before the first ECT session was administered and than 2 days after the 6^{th} dose of ECT.

Results and Discussion

The author stated "the pre-test scores were not different between the experimental and control groups at the pre-test, were substantially lower for both the experimental and control at the post-test, such that the patients' levels of depression changed after 6 session of ECT. Moreover, the 15 patients in the experimental condition reported lower levels of depression two days after the ECT than was observed for the control patients.

The pre-test post test change clearly supports the value of ECT as an agent of change in major depression among young women. There was a decrease in depression for the control patients, but this was statistically less than was observed for those patients receiving ECT. Therefore, patient improvement is better with ECT than without ECT.

Group assignment: assess the value of this study. Does it give you useful results for practice? What are the strengths and limitations of the research that impacts upon the usefulness of the study?

Figure 1 Timeline in the "aspiring science that is social work."*

Pre-scientific revolution:

427– 347 Plato
470-399 Socrates
348-322 Aristotle

130-200? Galen

400-900 Dark Ages, knowledge development is in Islam

1421 The Chinese sail to the Americas
Gutenberg (1390-1468): invents moveable type of wood & metal for printing press from 1436-1440; printing presses exits in China from at least 868bce
Da Vinci (1452-1519); inventor

1453 Turks capture Constantinople → Scholars fee to Italy = seeds of the Renaissance
Georg Peuerbach & Johannes Mueller (aka, Regiomontanus) translate Ptolemy from Arabic to Latin and insert the heliocentric theory, & influences Copernicus

1543 = Scientific Revolution

Copernicus: heliocentric & Vesalius: human autonomy; both published in 1543
William Gilbert (1540-1603): magnetism; experiments w/ systematic observation
Galileo (1564-1642): 1st pocket calculator; 1st thermometer
William Harvey, (1578-1657), circulatory system of blood
Descartes (1596-1650): innate ideas; a priori reasoning
Locke (1632-1704): tabula rosa; wrote Constitution for South Carolina
Newton (1642--1727) physics
Robert Hooke (1635-1703): pocket watch & microscope
B. Franklin (1706-1790); electricity, stove, gulf stream, 1st n=1 design in US
Hume (1711-1776): "mind" = entity/substance
James Lind in 1747 publishes "experimental" case studies to cure scurvy (n = 12)
Marshall Hall (1790-1857) reflex behavior
A. Einstein (1879-1955) relativity & curvilinear universe
Pierre Flourens (1794-1867) structure of brain
Florence Nightingale (1820-1910): invents the pie chart 1857
Darwin (1808-1882) & Wallace (1813-1913): evolution published in 1859
1855 first health board in US; 1861 NYC Health Board
Johannes Muller (1801-1858): Handbook of Physiology & energies of nerves
Mendel (1822-1884) genetics and theory of inheritance in 1865
Claude Bernard (1815-1878): endocrine process; "constant internal state"
Walter W. Cannon (1871-1945): homeostasis; emotions
Weber (1801-1878): touch, kinesthetic: JND of standard stimulus
Fechner (1801-1887): JND 1:40
von Helmholtz (1821-1894): rate of nervous impulse, theory of color & hearing
S. Freud (1856-1939); stuff
Wilhem Wundt (1832-1920) 1st text in psychology (1873); 1st psych lab
COS & scientific charity, 1877 Buffalo NY;
1894, Amos G. Warner publishes American Charities.

1902-04, Charles Booth publishes Life and Labour of the People of London
Jane Addams (1860-1935); sanitations, wider-self
1914 Kellogg, "The Pittsburgh Survey" & 1938 Klein "Social study of Pittsburgh"
J. B. Watson (1878-1958) behaviorism
Mary Richmond (1899) "social research" & social diagnosis
Sophie van Senden Thei (1924) evaluates "How foster children turn out." i.e., Charles Loring Brace's "orphan trains."
1933 SW Yearbook has section on "Research in social work"
C. R. Rogers (1902-1987); client-center and early researcher
1931 Richard Cabot calls for case evaluative research in sw
B.F. Skinner (1904-1990); reinforcement schedules; operant learning
1949, Social Work Research Group formed, folds into NASW in 55'
1949 Edwin Powers publishes 1st of Cambridge-Somerville Youth study.
1950 John Nash (1928-); equilibrium in game theory = literally changed the world
1960 Macdonald, Mary publishes first major text SW Research 1960
1960s to early 1970; Columbia U SSW produces number of influential researchers (e.g. Briar, Tripodi, Mullens, Thomas, Rosen) who go to other universities (e.g. Michigan, Berkeley, Chicago, Wisconsin) in late 60s and 70s and educate 2nd new generation of contemporary researchers (e.g., Fischer, Hudson, Proctor) giving rise to the current researchers (e.g., Thyer, Blythe, Glisson, Rubin, Soloman) and thus the current state of sw research

* Zimbalist, Sidney E. Historic themes and landmarks in social welfare research. NY: Harper & Row, 1977, p. 417.