

CENTRAL PENNSYLVANIA TORCH CLUB MINUTES (13 September 2017)

President Roy Hammerstedt called the meeting to order at 7 p.m. Treasurer Lee Stout reported that the treasury is constant and reminded everyone to pay annual dues, by a check made out to Central Pennsylvania Torch Club. There is a spousal rate, if a member has a wife or husband who wants to join. Jim Ultman introduced his wife, Deena. Roy distributed his report about our club, its accomplishments and opportunities. Of all age cohorts, the one growing fastest in Centre County is 65 and over; we should encourage retention of present members and invite retirees who have newly arrived. He introduced Ed Klevans, a retired professor of nuclear engineering.

Ed's topic was the current status of controlled fusion to produce power, which is difficult, may take 50 years to produce, and will cost billions to achieve. Advantages: lower radioactivity than fission; less risk of accidents; fuel taken from a type of water (deuterium), but to it must be added tritium, to be produced using lithium, an abundant salt, hence an inexhaustible fuel supply; advantageous environmentally, but not sure we can produce economically; no need to import resources, but we don't do that now. Possible benefits: will it meet people's needs, will it cost more and will it produce less waste than nuclear fission, will it be timely, considering how long it takes to build nuclear plants, how will it impact the environment relative to coal and natural gas, will the power produced be compatible with the existing grid, a problem in underdeveloped countries, will it allow diverse generation methods? Best fusion reaction we know now is combines deuterium and tritium. If they collide with enough energy, they produce helium and a neutron that carries away most of the energy, producing steam to drive a turbine that drives the generator. He discussed some alternative fusion fuels. One criterion is reactivity: how much heat is needed to cause the reaction? If Helium3 is needed, it is rare on earth, but ample on the moon. Mining and transporting would be costly, and the needed temperature is 10^{21} C, usually expressed as Kev where 1 ev is equivalent to approximately 10,000 K. Fusion power requires hot plasma that is fully ionized (fourth state of matter). The neutron escapes from the reaction chamber into a blanket, where it slows down until it can be absorbed by lithium, causing a reaction that produces tritium, the other fuel component. Since tritium is radioactive with a 12 year half-life it isn't found in nature. Ed spoke in terms of particles per cubic meter, compared atmosphere to higher vacuums or to high density. Ionized gases or plasmas exist in all stars, including our sun, and are held together by gravity.

Problem to confine hot plasma at high temperatures: gravitational confinement can't be used on earth, so we need either magnetic confinement, or inertial confinement produced, for example, by multiple laser beams hitting a small fuel pellet. This generates very high density for a billionth of a second. If you can reach fusion temperatures in the compressed pellet it will burn up with fusion reactions before it blows apart. This is because the speed of burning exceeds the speed of disassembly. For magnetic confinement the main concept is the Tokamak Device ("large current"): the creation of a twisting magnetic field, creating higher temperatures and longer confinement, a device developed by a Russian scientist, Artsimovich. The US built a better device with computers whose results could be processed. Further improvements were made by the Europeans, Chinese, and then South Koreans. Magnetic coils surround the electric current. Neutrons exit device and enter a lithium-containing blanket, from which is pumped out tritium that can be injected back into the device, mixed with deuterium and shot at high temperature, it collides with the material inside, replenishing the supply of plasma that has leaked out and heating the gas as well. Only Canada now extracts D_2 , from sea water. Requirements for a Magnetic Fusion Power Plant? Extreme temperatures are easy to get but hard to confine. John D. Lawson set criteria for energy confinement times plasma density. This parameter for fusion with the high temperature required has not been reached so far. Magnetic confinement (β), the ratio of particle pressure to confining magnetic pressure, so typically been around 5% but must try for 40% for economic fusion power. What methods can heat this deuterium-tritium fuel? Compress fuel, run internal electric current, beam neutral particles into the device, use microwaves to heat the electrons, and lasers. Energy taken out almost equals energy put in ($Q=1$), but we need ignition, and we're still working on this. The International Thermonuclear Experimental Reactor (ITER), being built by seven countries in Cadarache, France, aims at $Q=10$. Original estimated cost was \$5 bn, but it is now estimated at \$15 bn, and may go as high as \$20-25 bn; completion date was 2018, now 2027. Problems: coordination, design changes, and possible US dropout due to rising cost. Goal: 500 megawatts output or fusion of 50 megawatts input ($Q=10$). Pulse length run 500 seconds. To get to 500 seconds will take a very large power supply. Expect high costs of operating and maintaining ITER, a tall (60 m) device with huge

superconducting coils. ITER is an expensive experiment to learn how to hold plasma, maintain stability, dissipate heat load (using big divertor), handle radiation generated, cool the walls, and gain experience with alpha particles. Scientists must run the device for 15-20 years to learn how to handle fusion. At least 50 years of physics and engineering studies will be needed for effective nuclear fusion power, not 20 as originally expected.

Will we ever produce power economically using fusion? We are developing a smaller, spherical Tokamak, making efficient use of the magnetic fields, hoping to achieve a higher β level, using simpler divertors. No time to speak on inertial confinement. Questions: The difference between controlled fusion and uncontrolled fusion, which Klevans said are really hydrogen bombs; which countries are paying for ITER – EU, as the host country, about 40%, Canada, US, Russia, S. Korea Japan have a much smaller share; was “cold fusion” a hoax? Although it isn’t easy to reproduce the original experiments, it is now called LENR (Low Energy Nuclear Reactions) since it clearly wasn’t fusion. It is still an active field of research with promising results; Will sponsoring countries limit diffusion of findings? The answer is no, for publishing is still the lifeblood of research and development. However, when commercial companies get involved, they are highly proprietary, so final commercialization may be much more restricted in information out. It was noted that a campus plaque regarding discovery of deuterium is near Whitmore Lab. This is because Professor Brickwedde of the physics department was one of the co-discoverers of deuterium, but he came to Penn State after that discovery.

The meeting adjourned at 8:03 p.m.

Respectfully submitted, Art Goldschmidt, secretary

CENTRAL PENNSYLVANIA TORCH CLUB MINUTES (11 October 2017)

President Roy Hammerstedt called the meeting to order at 6:52 p.m. Al Turgeon announced that a series of discussions on the Vietnam War will take place at Military Museum on Sundays from 2 to 4 p.m. Ming Tien introduced his guest, Petra, a budding tennis star, and Lou Persic introduced his wife, Freddie. Roy reported on the recent officers' meeting. Members who say they are coming and don't show up must pay. We need to run our meetings closer to a schedule. John Vincenti has prepared the club website; members may address suggestions or additions to the president. We have made significant gains in membership and hope to continue to do so. There were no reports from the treasurer or the secretary.

Roy introduced Jim Serene, a retired orthopedic surgeon, who spoke on common problems of the foot and ankle. He was educated at Wake Forest, did his residency in Atlanta, and in addition to his practice also served on the faculty of Hershey Medical Center. He did many hip and knee replacements but had a special interest in feet and ankles. The human foot is unique in that it acts on a hard surface, bears weight, propels, and balances us. It consists of 26 major bones, 14 phalanges, and 33 joints. Two parts actually hit ground: the heel and the ball of the foot. The plantar fascia acts like the string of the longbow, maintaining the arch of the foot. The subtalar joint allows heel to go in and out. Ligaments check the tendency of the foot to spread apart; if the first and second metatarsals spread too far, a bunion may form. Pain on bottom of the foot, such as a corn, usually occurs under the second metatarsal bone. Sesamoid bones are small bones within a tendon, that serve as a fulcrum. Primates have a similar bone structure to humans. The extrinsic muscles are the strongest ones located in the calf. The foot has muscles but aren't so strong. Toenails help protect the toe. The big toenail is the slowest growing nail. Under the nail is the ungula, which helps create its shape. Injury to the Achilles tendon, which extends from the calf to the ankle joint, is extremely disabling. Tendonosis is an inflammatory process. Heel bursitis occurs just above the heel, some-times due to rubbing against a shoe, creating a bump. Treatment can involve removing a portion of the bone. An Achilles tear, a common athletic injury, is a rupture of fibers. The living cells in the tendon live on body fluid; they have no blood vessels.

A man over 35 playing basketball or tennis may get fatigued, make a quick step, and become unable to run or walk well due to Achilles Rupture. A noncompetitive athlete may wear a cast for a time (fibers may reconnect), but generally surgical treatment is indicated. Most ankle sprains are inversion. Some involve fracture, but usually not. Most sprains heal without operative care. Early motion and bracing help; the hard cast formerly used was ineffective. A question was asked about "high ankle sprains." the fibula and the tibia have a ligament connection, but enough twisting and turning may cause them to separate. This may require an operation. Heel spur syndrome, caused by tears in the plantar fascia, really hurts, especially upon first up but pain decreases as one walks. It is treated by stretching exercises. Heel cups and orthotics help somewhat. Are they the same as fallen arches or flat feet? Adult flat feet result from degeneration of the posterior tibial tendon. Shoes may help. If surgery is performed, recovery period is prolonged. Exercises are prescribed to keep posterior tibial tendon strong. Stress fractures are often just tiny cracks and don't show up in an x-ray. Common in marathon runners, long distance runners. Morton's neuroma is a pain shooting out from the bottom of foot toward the third and fourth toes, due to irritation of the digital nerve. Can be treated by shoes. The nerve may form a lump that can be removed surgically. Pain in the ball of the foot is usually due to cushion's wearing down due to age. It may be treated by padding. A callus, usually under the second toe, can be treated by surgery. Hammer toe (often the second toe) can be strapped, stretched, or surgically treated. Bunions occur when the first metatarsal head sticks out, and the big toe angles toward the little toe. Is wearing high heeled shoes harmful to women's feet? Possibly may lead to a bunion. There are over a hundred bunion operations written. Monofilament nylon stitches are advisable for skin closure. Gout is caused by uric acid crystals in the joints and can be treated by steroids. Ingrown toenails may get infected; they may be caused by skin growing around the nail's edge and apt to recur. Portion of the nail can be removed but incision must extend to the nail bed, or problem will recur. Fungal infections in toenails can't really be cured. Drugs cause liver problems. Melanoma can occur under the toenail, especially in blacks. Mosaic plantar warts occur in teenagers, not older people. Does a history of sprains or fractures cause problems for an aging person. If athletes have frequent sprains, surgery is indicated. Stress fractures, once healed, strengthen the affected area. Injury to the big toe causes many problems. Are foot injuries more common in women than men? Women get more bunions, possibly due to shoes, possibly hormonal, but little difference

between the sexes regarding other foot and ankle problems. Should podiatrists do what orthopedic surgeons do? Latter have six years' more training. Medical licensing is political in some states. Can a patient with plantar fasciitis resume his normal life? Yes, they can, and it rarely recurs

Meeting adjourned 7:57 p.m. 20 people attended.

Jim Ultman will talk on "The Six Million Dollar Man" next month.

Respectfully submitted, Art Goldschmidt, secretary

CENTRAL PENNSYLVANIA TORCH CLUB MINUTES (8 November 2017)

President Roy Hammerstedt called the meeting to order at 6:45 p.m. Art announced the next IATC convention, to be held 21-23 June 2018 in the Menger Hotel, San Antonio. Lee Stout introduced his guest, Carl Sillman, who was unanimously approved for membership. Roy reported Ed Buss's absence due to illness and introduced Jim Ultman, retired professor of biomedical engineering, who spoke on the "Six Million Dollar Man." In this television serial produced in the 1970's, Steve Austin, a badly injured test pilot was made whole again (and "stronger, faster") by the implantation of bionic devices. The idea of such devices precedes the television series by at least 250 years when Robert Hooke, an eminent scientist, wrote in his book, *Micrographia*, that "The next care to be taken, in respect of the Senses, is ... the adding of artificial Organs to the natural; ...one of them has been of late years accomplished with prodigious benefit ...by the invention of Optical Glasses." The purpose of this talk was to review some of the history and the current development of such devices.

Jim first discussed devices that aid in Locomotion and Work. The exoskeleton is a device, akin to the external skeleton of insects, that surrounds the body and provides power and control that allows the global movement required in tasks such as walking and lifting. The earliest known device resembling an exoskeleton was Yagn's running aid, patented in 1890 but never built. It was a simple bow/leaf spring operating parallel to the legs and was intended to augment running and jumping. In the late 1960s, General Electric working with Cornell University constructed a full body powered exoskeleton prototype the "Hardiman," a 1500 lb, hydraulically powered machine that included components for drastically amplifying the strength of the wearer's arms (including hands but without wrists) and legs. Exoskeletons were developed at Belgrade's Mihailo Pupin Institute in the 1970s: the "partial active exoskeleton," which used pneumatic actuators for flexion/extension of hip, knee, and ankle, as well as an actuated abduction/adduction joint at the hip. With many refinements since then, commercially available exoskeletons have aided patients who have lost motor functions of their lower limbs to walk again.

The need to replace limbs lost in accidents or by amputation has long been addressed by man-made prostheses. The world's earliest functional prosthetic body parts were artificial toes produced in Ancient Egypt. Only in the mid-20th century were major advancements made in the design of artificial limbs. In 1945 the National Academy of Sciences established the Artificial Limb Program to improve the quality of life of World War II veterans who had lost limbs in combat. Most recently, a revolutionary prosthetic hand controlled by a person's brain allows paralyzed volunteers to "feel" physical sensations from lost limbs. Skin sensors placed over motor axons on the shoulder or remaining portion of the person's arm carries electrical signals from touch sensors on the prosthetic fingers directly to the user's brain.

Sensing the Outside World was the second topic he addressed. Vision is perhaps the most important way that we sense our environment. As noted by Robert Hooke, eyeglasses (first produced in the 14th century) were perhaps the first cybernetic device. Current cutting-edge technology has enabled us to progress far beyond eyeglasses. For example, the Argus II Retinal Prosthesis, a device developed by a team of physicians and engineers from around the country, aids adults who have lost their eyesight due to retinitis pigmentosa (RP), age-related macular degeneration or other eye diseases that destroy the retina's light-sensitive photoreceptors. In April 2013, the FDA approved what it called "this first bionic eye for the blind." The heart of the device is a tiny yet computer chip that, when implanted in the retina, sends electrical signals directly to the optic nerve, thereby sidestepping the damaged photoreceptors in the retina and tricking the eye into seeing.

Hearing is another important way in which we sense our environment. Sir Francis Bacon, a champion of modern science, studied hard-of-hearing people. In his book, *Sylva Sylvarum: A Natural History* (1627), Bacon proposed the first hearing aid. He writes: "Let it be tried, for the help of hearing (and I conceive it likely to succeed), to make an instrument like a tunnel; the narrow part whereof may be the bigness of the hole of the ear; and the broader end much larger, like a bell at the skirts; and the length half a foot or more." This ear trumpet, like a contemporary hearing aid, amplifies sound waves to more greatly stimulate the inner ear's cochlear hairs. Some patients have such severe dysfunction of the cochlear hairs that amplified sound cannot stimulate them. Similar

to the bionic eye, the cochlear implant is a modern, commercially available device that bypasses the damaged cochlear hairs with a computer chip that directly stimulates the auditory nerve.

The final bionic devices that he described were those used for Nutrient & Waste Processing, normally performed by internal organs. As an example, the discussion was focused on the removal of metabolic waste products that normally occur by the natural kidney. Currently, kidney failure is only fully treated with a kidney transplant, but thousands of patients die each year due to the scarcity of donors. Peritoneal dialysis is an established method of replacing kidney function, temporarily at least. The peritoneum is a thin, shiny, richly perfused membrane that covers the whole abdominal cavity. During peritoneal dialysis, a special fluid – the dialysis solution – is introduced at regular intervals to the abdominal cavity through a catheter. This fluid surrounds the peritoneum and allows metabolic waste products to pass from tiny blood vessels through the peritoneal membrane into the dialysis fluid. The dialysis solution carrying these substances is then removed several hours later and replaced by fresh solution. Between 1924 and 1938, medical teams in the US and Germany performed the first regularly repeated – or intermittent – peritoneal dialysis treatments and proved that the procedure can replace for the kidneys' natural function temporarily. Today, commercially available, automated machines can perform Continuous Ambulant Peritoneal Dialysis (CAPD) while a person sleeps.

The most common treatment of kidney failure uses an extracorporeal artificial organ—the hemodialyzer. Instead of separating blood and dialysate solution through the peritoneal membrane, this device uses an artificial membrane outside of the body to which those fluids are continuously routed. Hemodialysis treatments under medical supervision requires some three sessions per week, for three to five hours per session. The father of dialysis is Dr. Willem Kolff, a young Dutch physician who created the first dialyzer (artificial kidney) in 1943. Working in a remote Dutch hospital with fear of discovery by the Nazis, he resourcefully improvised, using sausage skins, orange juice cans, a washing machine and other common items to make a device that could clear the blood of toxins. Today roughly 350,000 patients rely on kidney dialysis, which is costly and also takes a human toll. It is exhausting for patients and replaces only 13 percent of kidney function. As a result, only 35 percent of patients survive for more than 5 years.

A longer-term solution would be to build an implantable, self-monitoring, and self-regulating kidney that could continuously process circulating blood. This is the ultimate goal of The Kidney Project at UCLA. Their current hybrid device, operates just like a natural kidney, not requiring the use of dialysate solution. The device has a hemofilter module containing an man-made ultrafiltration membrane that passes toxicants and water from blood. It also includes a cell bioreactor module containing kidney cells which reabsorbs water back into blood. The concentrated waste solution is then exhausted into the natural bladder.

In considering What the Future will Hold, the serious question is not whether we will ever create a complete living bionic man like Alex Murphy, a terminally wounded cop who returns to the force as a powerful cyborg in the 1987 movie “Robo-cop.” Rather, will we be able to perfect devices that can serve as reliable and affordable replacements for organs and limbs? This will require application and advances in engineering technologies such as nanotechnology, 3-D printing, and tissue engineering. We also need to learn more about the physiology of the human brain and its interface with electronic devices.

Questions from the audience: Does a person have to be physically connected with an operational/artificial body part? Must an artificial body part resemble its human form, even if its actual appearance is not fully functional? What happened to the Penn State Heart? How does this research relate to artificial organ donation and transplants for decisions made by physicians, family members, and patients?

Attendance tonight was 20 people, including 3 guests. Roy Hammerstedt announced that the next meeting, on 13 December, will feature Lee Stout speaking on “What Do We Learn from Centre County History?” The meeting adjourned 8:02 p.m.

Respectfully submitted, Art Goldschmidt, secretary

CENTRAL PENNSYLVANIA TORCH CLUB MINUTES (13 December 2017)

Roy Hammerstedt called the meeting to order at 6:43. The treasury is fine. Secretary invited a volunteer to go to next June's IATC meeting in San Antonio. Guests introduced: Bob Martin, Scott Kretchmar, Kathy Sillman, Karen Miller, Linda Hendrickson, and Dee Stout. Roy spoke about our rapid turnover of members and the need to recruit and retain them. He consulted five former presidents. We might consider new modes of operation to stimulate member interaction. Must we adjourn by 8 p.m.? Can some members continue our discussions after others have left? We might post questions on our website for online discussion. May we suggest topics for others to discuss? Can we invite two members to present opposing points of view briefly, followed by an open and civil discussion of the issue? How else might we expand our outreach? Can we extend our outreach to vetted groups? Can we promote professional links? Can we invite outsiders to access our website for online discussions?

He introduced Lee Stout, former University Archivist, who spoke on Centre County history. Earlier he had studied 18th century China but working one summer on an archaeological dig in Curtin Village and later working on Centre County materials in the Labor Archives led to an interest in Penn State's history. Having completed his book on Beaver Stadium, he may write a history of Centre County. Most of us have come as transplants but he feels that we must learn about our environment: its geography and geology, peoples, iron industry, post-civil war industries, and its role in higher education. Geographically, the county is part ridge and valley, part Appalachian plateau. The area once had high mountains that eroded, leaving dolomites and limestone in the valley, with out-croppings of iron ore. Lee showed a 1756 map, almost without information on what is now Centre, except Bald Eagle's Nest. Most native Americans used the area for transit and hunting. Indian raids into Penn's Valley during the Revolution led to settlers' flight to Sunbury. Some settlers were English, Scots-Irish, or German, but most were Pennsylvanians coming from the east via the Susquehanna River and Bald Eagle Creek. The main west-ward movement bypassed Centre County; most who came stayed. Agriculture predominated, but iron making rose in the late 18th & early 19th centuries: 13 iron furnaces and forges in Centre County at its height.

Most were in rural areas; ironworkers also grew crops to feed themselves. Lee illustrated how iron was transported, smelted, purified, and cooled into pigs. Blast furnaces ran for as long as there was charcoal and as long as men could work. They stopped to harvest their crops. Carried by mules. iron went out to Baltimore, later Pittsburgh, a hard task. The iron industry made Bellefonte rich, powerful, and the home of six state governors. It was one reason for the location of Farmer's High School, hence Penn State, when six other counties, all in central or western PA, wanted the school. The iron industry declined after the Civil War. Steam-powered factories arose in Bellefonte and Millheim, also coal mines on the Appalachian Plateau. Centre County's population was 11K in 1810; now more than 140K, due to Penn State's growth from Atherton's and Sparks' presidencies on. Penn State's focus on engineering helped, as did having major industrialists as trustees. Smokestack industries & railroads rose and fell in Centre as elsewhere in PA. Its workers and farmers were ethnically diverse. Jeffersonian Democrats prevailed in Centre's politics at first, then Whig industrialists, and later Republicans. Bellefonte was its largest city; now State College and its suburbs dominate. Local unemployment is low; people now commute to Penn State from great distances. He noted declining state support for higher education. A lively discussion ensued. Why was Centre chosen over all other counties for the school? A board visited all seven; local Whigs influenced its choice. Roger Williams explained the 1857 board's rationale. Lee explained the Land Grant Act. The County's area exceeds that of Rhode Island. Why the spelling of Centre? What is Penn's View? What kind of work did early students do? State funding for Penn State is sparse compared with Midwestern state universities, due to private colleges' competing for appropriations from the state legislature, causing a reluctance to build a Penn State endowment. The meeting adjourned at 7:55. 31 people attended.

Next meeting on 10 January. Gordon DeJong: "The Changing Demography of the American Family."

Respectfully submitted, Art Goldschmidt, secretary

CENTRAL PENNSYLVANIA TORCH CLUB MINUTES (10 January 2018)

Roy Hammerstedt called the meeting to order at 6:45 p.m. Treasury is unchanged; secretary announced the next IATC convention, to which we'll probably have a representative. Ed Buss introduced his guest, Bob Butler. Jim Ultman proposed Scott Kretchmar for membership. He was unanimously approved. Roy plans to convene the executive council in the next few months to consider ways to grow the club. He introduced Gordon DeJong, Professor Emeritus of Sociology and Demography, speaking on "The Changing American Family."

The family as an institution is the bedrock of every society, but where is it headed? He will use US social science data to identify the trends. He was once asked to estimate the number of uninsured child-ren in Pennsylvania, when a House member disputed his definition of "family," insisting that it must include both a father and a mother. Is there now a retreat from marriage in the US? The evidence is mixed. About 90% of young people expect to marry, but significant changes are occurring. The trend in the 18-24 age group is to delay marriage, most likely due to inadequate income. Black women are now, compared with 1940, much less apt to marry by age 40-44, due to high rate of black male incarceration, but whites have changed little. Cohabitation is increasingly common for all educational levels. It may precede marriage, especially for women with less than high school education. Cohabitation is replacing marriage as first live-in romantic relationship. The average length of cohabiting relationship is 3 years, shorter than in Scandinavian countries. For college-educated women, it is increasingly common that cohabitation transitions to marriage; not so for less educated groups. Less educated are motivated by economics; educated women want to be sure of compatibility. Is marriage tending to decouple from childbearing? The share of nonmarital births has risen: 5% in 1960, 40% now. But single mothers are constant; the rise is for cohabiting units.

Blacks, especially single mothers, continue to have the highest rate of nonmarital births. Hispanics' children are born increasingly to cohabiting couples. Career and economic security motivate college-educated women. Hispanics especially want to have children, even in a nonmarital relationship. Public policies have lagged behind these trends, favoring children born within marriage. Divorce rate shot up in the 1970s due to no fault divorce laws, but since then has stabilized. It varies among groups. The baby boom cohort has had a rising divorce rate, even now, but fewer young people get married and more live in a cohabiting relationship. Americans, notably seniors, are more tolerant of divorce and cohabitation. College graduates are most apt to stay married. Do kids in two-parent families (married or cohabiting) fare better than those in other situations? About 40% are in complex family patterns, but others are in a complex family relationship for part of their growing years? Obviously, economic resources matter, as does how much time the parents spend with their kids. Less stress on the kids and more love within the family context matter? The Fragile Families Survey has measured these variables. Much higher material resources exist in two-parent families, married or cohabiting. In a broken family, the stepdad's involvement matters. The secular trend is toward women's getting higher education. Birthrate has fallen in almost all ethnic and income groups, making material resources more available per child. Healthcare has improved, due to CHIP and the ACA.

Questions: effects of three generation families, lower black marriage rates, the neighborhood children grow up in, welfare programs, black women wanting children but not marriage, changing cultural pat-terns for which we lack data, low divorce rate among Chinese Americans, do kids fare better in a toxic marriage or if parent's divorce, how the US birthrate stayed at replacement level (at least until recently), changing cultural norms such as rising acceptance of nonmarital relationships, effect of Social Security laws, and how have longer lifespans changed family dynamics. Meeting adjourned at 8.00. 26 attended.

Respectfully submitted, Art Goldschmidt, secretary

CENTRAL PENNSYLVANIA TORCH CLUB MINUTES (14 February 2018)

Roy Hammerstedt called the meeting to order at 6:55 p.m. Marylee Taylor introduced her guest, Emilie Allan, retired sociologist, who is also a singer. Roy noted that Club membership inches up but we need to recruit more. He sought suggestions; got just one from a member so far. Our Bylaws stipulate that the Executive Council names two committees: Program, chaired by the President-elect, which lines up speakers from within the Club, but a precedent exists for inviting outside speakers, and Nominating, chaired by the President. Roy has read our Club's records. Our membership numbers have varied from 55 down to the usual 30. He has made a list of topic titles during the first ten years, many could be done today. For the election of future officers, Roy recommends lightening the Secretary's workload, but the Treasurer job is pretty easy. He introduced Gary Miller, Executive Director Emeritus of Penn State's World Campus, who spoke on "Toward a Learning Society: The University in the Information Age."

What are universities doing with information technology now and what will be the impact in the years to come? Gary focused on three elements: online learning, open access resources, and social media. Penn State's World Campus has been teaching online since 1998, a pioneer among universities in using the internet for undergraduate and graduate education. Distance education is changing how universities relate to students on and off campus, promoting collaboration among institutions, creating academic alliances to improve teaching and learning, and sharing courses in fields like rarely taught languages. Open educational resources, defined as "high quality teaching, learning, and research materials that are free for people everywhere to use and repurpose," reduce duplication of effort and transfer research findings into practice. This sharing is becoming worldwide; in the US it has flourished in community colleges, increased collaboration between K-12 schools and higher education, and fueled curricular innovation. It is lowering costs for students. Micro-degrees, badges, and certificates now supplement university degrees. It has enabled services to collect data on how students learn from online courses. There is now a working group studying the outcomes of these innovative programs. These innovations are beginning to move us toward a K-14 educational environment and may stimulate changes in the undergraduate curriculum. The social media have enabled institutions to create sustained learning communities focused on specific professions and has the potential to promote formal collaboration among educators, school superintendents, librarians, and various industries and specialists. This should lead to high quality, lifelong education, with major consequences for society.

A lively discussion ensued: What role for teacher-scholars? Will traditional education's socialization benefits vanish? Will it stifle or promote teacher-student interactions? How have Penn State alumni reacted to the World Campus? Does online learning enhance faculty and student collegiality? Will online courses lower the cost of a college education? Will it undercut traditional methods because it is more economical? What is the actual market for online education? What is the value of a degree earned mainly by online education? How do the characteristics of faculty who teach online compare with traditional teachers? Can a good teacher teach well anywhere, if s/he is willing to learn new methods? What about the staff's role in support positions? How has distance teaching of archaeology benefited a neighboring institution? What are the rewards and penalties for professors who must produce research if they must also develop online courses? How do freedom of action and access to worldwide students draw people into academic life, as compared with financial incentives for teaching online courses? Can the success of these innovative methods be measured? Are there studies? Can we recall great professors and their impact? Can a teacher who is always available online do as well? Can online teaching, along with hands-on experience, teach how to do a job better than a lecture?

The meeting adjourned at 8 p.m.

The next program on 14 March: Roger Williams speaking on Evan Pugh. Attendance tonight was 17.

Respectfully submitted, Art Goldschmidt, Secretary

CENTRAL PENNSYLVANIA TORCH CLUB MINUTES (14 March 2018)

Roy Hammerstedt called the meeting to order at 6:50 p.m. There were no reports from the treasurer or the secretary. Jim Serene introduced his guest, Vince Gatto, Professor of Italian at Penn State, who is not a potential Club member. Roy stated that his recent emails to all members are intended to save time during our meetings. Our bylaws call for a nominating committee; anyone wishing to volunteer to serve on it should contact Roy. Mick will circulate a volunteer sheet during the April meeting to line up speakers for the 2018-2019 program year. Roy has received brochures from the San Antonio Club advertising the IATC meeting in June 2018. He hopes a member will volunteer to attend. He described his research in the Torch Club archives; many talks from the 1950s and 1960s could be given now.

He introduced Roger Williams, who spoke on his newly published book, *Evan Pugh's Penn State: America's Model Agricultural College*, which provides a full biographical treatment of the mid-nineteenth century scientist-president (1828-64) who forged the nation's first successful higher education institution dedicated to scientific agriculture. Pugh's Agricultural College of Pennsylvania, today's Pennsylvania State University, set a high academic standard, graduating an inaugural class of 11 in 1861 with the nation's first Bachelor of Scientific Agriculture degrees. Pugh also worked with colleagues to push for the passage of the Morrill Land-Grant College Act in 1862. He then quickly engineered the acceptance of the act by the Pennsylvania legislature in April 1863 and the designation of the Agricultural College of Pennsylvania as the act's beneficiary. A year later, Pugh was confronted with stiff political opposition in legislation introduced to repeal the state's acceptance and re-apportion the Morrill Act proceeds to additional colleges and other purposes. Pugh's vision for scientific agriculture went well beyond Pennsylvania. He advocated for a large-scale national system, to include additional agricultural colleges modeled on his "great experiment" in Pennsylvania, subordinate agricultural high schools, a federal department of agricultural, agricultural experiment stations, and the collection of statistics on all things agricultural. Seeking to accelerate the development of the agricultural sciences,

Pugh believed that the nation needed a model agricultural college at the apex of this system. To do all of this, Pugh prepared himself as scientist. Raised in a family of Welsh Quaker farmer-blacksmiths in Chester County, Pa., Pugh patched together an education, founded his own academy, and left in 1853 for advanced study in Germany. After studying in Leipzig, he received his Ph.D. in chemistry from Göttingen in 1856. After additional study in Heidelberg and Paris, he moved to the Rothamsted Agricultural Experiment Station in England. There he conducted an elegant experiment that settled an international controversy on how plants assimilate nitrogen – from the soil rather than the atmosphere. His research earned him a Fellowship in the London Chemical Society and laid the foundations of the modern ammonium nitrate fertilizer industry. His long-held goal, however, was "to develop upon the soil of Pennsylvania the best agricultural college in the world for the agriculture student of America." Thus, he returned to Pennsylvania in 1859 and proceeded to do exactly that, his academic standards being European, not American. He was twice offered the post of chief chemist with the new federal Department of Agriculture, but twice turned it down. A visionary with a driving sense of purpose, he developed in the last year of his life an extensive organizational plan for colleges of agriculture and the mechanic arts, published in the appendix, that reveals the thinking of an academic leader ahead of this time. The tragedy for the Agricultural College of Pennsylvania, and for the emerging scientific agriculture movement in America, is that Evan Pugh died in April 1864 at age 36, the victim of the lingering effects of an accident, a crushing workload, and finally, typhoid fever.

A few questions: how did he finance his education in Europe? Did the Legislature view as excessive the amount he requested to build Old Main? What happened to the early graduates? Did the Civil War affect student retention?

Mick McKay to speak 14 April: "Advancing Technology in our Lifetime."

Respectfully submitted, Art Goldschmidt, secretary

CENTRAL PENNSYLVANIA TORCH CLUB MINUTES (11 April 2018)

Roy Hammerstedt called the meeting to order at 6:50 p.m. The 14 March meeting minutes were accepted. Lee Stout reported that the current balance is \$2,325; a year ago it was \$2736. Major expenditures have been our meals, IATC dues, printing, and supplies. John Golbeck introduced his guest, Bill Arden, who is interested in astronomy and photography. Lee introduced his guest, Harry West, a retired professor of civil engineering and coauthor of the *Lair of the Lion*. Mick McKay introduced his wife, Joyce. Roy asked for a volunteer to attend this year's IATC Convention in San Antonio and for people to serve on a nominating committee to choose next year's president-elect. Our bylaws also call for a program committee to find 2018-2019 speakers before our June meeting. He seeks a secretary-elect, as the present secretary plans to retire. It would help if each speaker prepared a digest of his talk; then the secretary would not have to type notes. The minutes are now posted on our website. Roy wants to appoint John Vincenti as our webmaster because our Bylaws don't mention this office. Eleven other clubs have websites but fail to update them. A website should be accessible to others. Roy has read our records and Bylaws, which should be updated, and compiled a list of members who have served as president.

He introduced Mick McKay, who spoke on Artificial Intelligence: Advancing Technology in our Lifetime. McKay defined Artificial Intelligence as systems that can make certain decisions on their own. He identified the major inventions in the lifetime of each generation, e.g., the Internet for the millennials. The 1950-1980 timeline was the age of plastics, but also the appearance of card punch, mainframe computers focused on complex calculations. Businesses then neglected AI. When a computer program for language translation was tested, "The spirit is willing, but the flesh is weak" came out as "The vodka was good, but the meat was rotten." Moore's law posits that computer power doubles every 18 months. One cellphone today has power equal to the total available to NASA engineers at the time of the moon shot. Personal computers came out in 1980, laptops around 1989. Experiments with the Deep Blue computer showed that it gradually gained power to tie and then defeat a Grand Master. Driverless cars were first tried. We have steadily raised the number of transistors on one chip from 1 in 1956 to 68 billion in 2017, giving computers the ability to make more choices and move into logical reasoning. By 2010 a computer could learn the rules of Jeopardy and defeat a master. Computers now are learning how to win at poker. New applications facilitate military strategy. We now have robots and driverless trucks. Early topics for AI development included natural language, automatic language translation (>39 languages as of five years ago), computer vision (for crime investigation), and searching information via the Internet.

Expert systems are appearing that separate reasoning power from the expert's knowledge database: a machine can interact with its operator, consider how likely the rules may be correct, and even use fuzzy logic. Non-experts can operate them. He described how a driverless car works. It outperforms any driver because it perceives road conditions in all directions all of the time, amassing a better safety record than any human, and will dominate long-haul trucking. Some predict that flying cars will be on the market by 2020-21. AI applications: hearing aids, patient care, surgery, body scans, replacing body parts, and outer space transport. Chinese engineers have taken the lead in security applications: smart glasses can identify suspects in a crowd. US uses robots in industry to replace routine human labor. Steel output has risen 38% while using 42% fewer workers. Robots can only do one task at a time so far, but we soon will create a robot that can act like a human. McKay distinguished between artificial intelligence and machine learning. Data can have millions of dimensions, make complex predictions, spot correlations, note corrections, and recall mistakes to avoid. As data grows as evidence, the probability of a hypothesis can increase. McKay showed an artificial neural network, one that may have many layers, leading to a conclusion. Its chances for accuracy tend toward perfection. A computer never forgets what it has learned. Do computers reduce human interactions and privacy? Machines perform tasks better, faster, and at lower cost, so we rely on them more and more. When will the machine equal and surpass human intelligence? 65% of experts polled predicted 2030-2050; only 2% said it will never happen. China, which aspires to take the lead by 2030, is spending more on AI than the US. He compared North American vs. Asian expansion. Russia lags behind. AI can be both good and bad. Stephen Hawking has warned that humanity can be infinitely helped or conceivably destroyed by computers. They grow in power, while their chips constantly decrease in size and cost and transistors gain greater capabilities.

Questions followed: AI can function within a decided framework, but without one, statistical predictions fail,

and errors become more likely. China's computers work on 5G; ours on 4G. Their system is thousands of times faster. We face dangers as computers exceed our understanding and we fall back on learned helplessness, e.g., driverless cars will weaken people's ability to drive. Humans may get paid a salary for doing nothing. Roy announced next month's program:

The meeting adjourned at 8 p.m. 25 members and 3 guests attended.

Richard Held will speak on the world economy in 2050.

Respectfully submitted, Art Goldschmidt, secretary

CENTRAL PENNSYLVANIA TORCH CLUB MINUTES (9 May 2018)

President Roy Hammerstedt called the meeting to order at 6:58. The secretary and treasurer had no reports. Dick Held introduced his guest, Paul OHern. Lee Stout proposed Harry West, a retired Penn State Professor of Civil Engineering, for membership, which was approved unanimously. The IATC urges our Club to send a delegate to its annual convention in San Antonio; both the Association and the Club offer subsidies for travel costs. Any interested member should inform Roy soon. He and Gary Miller, as the Nominating Committee, proposed the following candidates for 2018-19: President McKay, VP (President-elect) Held; Treasurer Stout; Secretary Goldschmidt (with Hammerstedt volunteering himself as secretary-in-training, as no other member was willing). Roy will serve as secretary in 2019-20 and train a successor for 2020-21. The members unanimously elected these officers. Starting tonight, each speaker will give the secretary a summary of his Torch Talk. Roy then introduced Dick Held, who spoke on "The World Economy in 2050."

Dick based his talk on a projection drafted by the London office of Price Waterhouse Coopers, the world's largest consulting firm. Between 1985 and 2015 the main trends were the rapid economic growth of China and India (spurred by high capital investment), the collapse of the Soviet Union, and the lost decade of Japan's economy from 1991 to 2003, followed by a slow recovery. PWC expects a GDP increase between 2015 and 2050 of the US economy from 18 to 41 trillion dollars, China from \$20T to \$61T, India from \$7T to \$42T, and Indonesia from \$2 to \$12T. The countries having the highest GDP in 2050 will be the US, China, and India, which together will make up 50% of the world's total output, followed by 29 other countries producing 35% of the total. PWC predicts the world economy to double by 2037 and triple by 2050. Asian and African countries, such as Indonesia, will gain, relative to the countries of North America, Europe, and Japan. Seven of the world's fastest growing economies will be in Asia and the other three in Africa. Factors for growth include rising working-age population, education and job training, capital investment, and technological progress. The UN estimates that Africa's population will increase by 50%, Asia and the Americas by 20%, but Europe's population will remain stable. Overall world estimates are from 7.8 billion currently to 9.8 B in 2050 to 11.2 B in 2100. Major factors are women's declining fertility rates and rising life expectancy. Although India's GDP will rise more rapidly, the established countries with slower-growing economies, such as the US and China, will rank higher. The US economy is projected to grow at 2% annually. The PWC report identifies the largest risk factors for the worldwide projection would be declining growth of labor productivity due to aging populations, declining rates of investment, and deceleration in technological progress. If all three of these factors occur, the projected overall growth rate would decrease from 3 to 2.4% annually by 2050. The PWC experts differed as to whether this might happen, but all noted the recent low growth in US productivity (1.8% annually) due to low investment, secondarily to the rising number of retirees on Social Security and/or pensions.

A lively discussion ensued. Questions included effects of climate change, immigration as a factor in US population growth, the unpredictability of national leadership, variable income distribution, countries that formulate plans using these projections, how to compensate for an aging population, whether rising GDP will lead workers to demand higher wages, whether automation will lead to paying some people not to work, as per Mark Zuckerberg's recent proposal, possible differences between free enterprise and managed economies, whether any of us will live to verify or refute these predictions, effects of business cycles, and the probability of countries' economies catching up with China's.

Before closing the meeting, Roy announced Ming Tien's talk, "Drug Addiction: Sociological, Biochemical-Personal Accounts," to be given on 13 June. Mick stated that the Club needs one more member to volunteer to give a paper in 2018-19. Roy pointed out that, if we current members recruit more people to join, we would not have to give papers so often.

The meeting adjourned at 7:55 p.m.

Respectfully submitted, Art Goldschmidt, secretary

CENTRAL PENNSYLVANIA TORCH CLUB MINUTES (13 June 2018)

President Hammerstedt called the meeting to order at 6:50 p.m. Ming Tien introduced his five guests (Steve Beckerman, Don Schule, Michaela Amato, Doug and Marcia Collins).

Roy introduced Ming, a member of his department, who spoke on the biochemical, sociological, and personal aspects of opioid addiction, which is a primary disease of brain reward, motivations, memory, and related circuitry. There are actually many forms of addiction, including various behaviors. Addictive behaviors are detrimental when they interfere with other aspects of one's life. Causes include heredity (drawing on twin studies), ease of access to drugs, personality disorders, and childhood trauma. The pleasure center in the brain, notably the release of dopamine, an important neurotransmitter, leads to reward-driven reinforcement of addiction. Ming described experiments with rats and mice injected with cocaine, heroin, nicotine, or alcohol. Such injections resulted in a greater than 10-fold increase in dopamine in the brain. Dopamine release is associated with the pleasure response. Their euphoric effect reinforces drug use behavior and can overwhelm a good and fruitful life. It is extremely difficult to withdraw from opioids and other drugs. Detox treatment can be medically dangerous, even fatal, to the addict. Ming diagrammed how dopamine release is affected by cocaine, poppy, and synthetic opioids, most notably fentanyl, leading to the death of about 52,000 Americans this year and half a million in the next decade. Opioids can even stop one from breathing. He showed diagrams of how the poppy plant can be processed into heroin and hence Oxycodone and other prescription drugs. Two-thirds of those who have abused these drugs started out with prescription sources. US consumes 99% of world's hydrocodone, 81% of its oxycodone, but as far back as the Civil War we abused morphine.

He showed the correlation over time of opioid prescribing and drug deaths in West Virginia. Four in ten Americans know someone with an opioid addiction. Oxycontin, comparable to heroin and twice as powerful as morphine, was approved in 1995 and is now the world's top-selling painkiller, pushed by pharmaceutical sales representatives. It was hailed as less addictive, but this proved not to be true. A company memo indicated the knowledge of the dangers of addiction, yet the company misled the public into thinking otherwise. Three Purdue Pharma executives were prosecuted and convicted in 2007, yet they continued to market the drug. Purdue can determine which doctors overprescribe the drug and can spot nonmedical users. Two thirds of all opioid addicts started with prescription pills. Fentanyl, 50-100 times more potent than heroin, comes from clandestine labs in China shipped via Mexico. There is no one standard method of rehab treatment. It is estimated that 23 million Americans are addicted to alcohol or drugs. Almost all treatments use the 12-step method, which he described. Families should keep trying to help addicts and not freak out over relapses. His son, a recovering addict, suffered depression in his sophomore year, then studied and worked, but was distressed by deaths of eight addicted friends. His behaviors included stealing, shoplifting, and drug abuse. Since then he has completed an honors degree program in engineering at Penn State. Ming still must take extreme precautions. Treatment after the addict stops using the drug is hard; enabling the loved one is hardest of all. Free will exists, but drugs take control during the addiction period. Behavioral disorders are many times associated with addiction. Our culture assumes that there must be a pill for every problem. We must admit that some pain is good and learn how to cope, but by resorting to pills some people never learn this. Recovery is a lifelong process. There are many support groups for the user and those who love him. The devil is in the details: how can we help the user we love without enabling the user's addiction?

Questions in the ensuing discussion: What was the key factor that accelerated drug addiction in 1980s? Was oxycontin licensed to just one company? Do we have too many rehab centers? Does the government's war on drugs cost more than medical treatment? Does any chemical treatment exist that can cure addiction? Have we neglected research in "soft sciences," such as psychology and sociology, given the shortcomings of relying on "hard sciences?" How did our historic sugar trade compare with current drug trade? How do addicts obtain drugs on the street?

Roy thanked Ming and announced that our next meeting is in September, when Mick McKay will assume the presidency.

The meeting adjourned at 8 p.m. Attendance tonight was 29 persons.

Respectfully submitted, Art Goldschmidt, secretary