Radicalization of Life Scientists
to Terrorism

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Abstract
This project examines common trends in the backgrounds of life scientists that have been radicalized to terrorism. This examination required a review of the general radicalization and recruitment processes, a comparison of the path that life scientists (individuals with technical skill in the biological sciences) take to violent extremism, and an evaluation of several discrete variables covering the background and characteristics of documented terrorists. By examining 18 cases of radicalized scientists, this paper aims to outline a more focused method for threat reduction groups to identify scientists with applicable weapons of mass destruction (WMD) skills that are at high risk of working with terrorist groups. Nine cases consist of scientists that committed, or attempted to commit, acts of biological terrorism and the nine other subjects are scientists with applicable weapons of mass destruction (WMD) skills who chose to commit other acts of violent extremism. By comparing these groups to each other and to the general terrorist population, this thesis concludes that several factors provide counter-terror groups with guidance and indicators that will assist in identification of potential threats to security. The paper also provides evidence contrary to common theories about several radicalization factors previously believed to be indicators, which did not prove to be explanatory with regard to scientist radicalization. If these factors can be identified and demonstrated as predictive, scientists with WMD applicable expertise fitting this profile should be engaged as a top priority by the United States Government (USG) non-proliferation community.
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Background

Biological weapons are bacteria, viruses or toxins that are deployed with the attempt to sicken or kill one’s targets. Biological warfare programs were undertaken by a variety of leading states, including the U.S., after WWII. However, subsequent to the signing of the Biological Weapons Convention in 1972, bioweapons became outlawed by international agencies, and currently no state publicly admits to an ongoing offensive weapons program. Biological weapons can be contagious, invisible and not well understood by the public. They tend to have a profound psychological impact on the general population.

Biological weapons (BW) are recognized by the U.S. Government as a serious threat to national security. These Weapons of Mass Destruction (WMD) are considered particularly dangerous on the basis that they are more easily obtained and produced than nuclear weapons, and have greater destructive power than chemical weapons. The destructive power of bioweapons and their capability to cause mass morbidity and mortality is the reason the U.S. Government should focus their attention on the prevention of biological weapons dissemination. While estimates are considered rough, due to declared state sponsored biological weapons programs being a thing of the past, biological weapons are the only weapon commonly cited to have comparable destructive power to nuclear weapons.

Accessibility, low cost and the small footprint of biological agent production make the use by terrorists of dangerous biological agents an increasingly serious concern. A number of terrorist groups have expressed interest and intent in attacking America with biological weapons. One of the main hurdles terrorists must overcome to acquire, produce and disseminate bioweapons
is obtaining the appropriate technical expertise. Although the recent genetic revolution of the biosciences has made complicated life science experiments and research easier to apply at low tech laboratories; the tacit knowledge required to produce a biological weapon of mass destruction is not common among the terrorist community or the population as a whole. Training in the biological sciences takes years of study in a university (or comparable) setting and requires hands on experience in a specialized laboratory. The fact that individual technical expertise is such a key component in BW production, illustrates why preventing scientist radicalization and recruitment to terrorist groups is of paramount importance. Threat Reduction groups at the Department of State and the Department of Defense are charged with identifying and minimizing the potential for terrorist acts against the U.S. These programs work to engage “at risk” scientists around the world to assure their expertise is not used to assist terrorists in acquiring or disseminating a WMD.

This paper’s aim is to gain a more thorough understanding of specific factors in the background of a selected group of radicalized life scientists. Outcomes of the research will no doubt be difficult to apply, because engagement programs generally do not have access to the full backgrounds of the individuals with whom they are working. However, useful conclusions are drawn that should benefit the non-proliferation community as a whole.

**Project Description**

The outcome of the project is a discussion of factors that non-proliferation programs can use to identify “at risk” scientists. The overwhelming majority of the “at risk” biologists are constructive members of the legitimate scientific community, and will never be a part of
terrorist activity. They should not be singled out for any negative action or surveillance based on the broad categories that this research presents. Non-proliferation programs advocate positive engagement, encouraging people with valuable skill sets to continue on a legitimate career path, this research will merely help to focus those programs on individuals that most need their help. This project cannot and does not attempt to distinguish which individuals will be radicalized or recruited to terrorism in the future, but attempts to establish patterns to narrow the pool of individuals the USG should engage.

When prioritizing expertise in preventing bioterrorism, the main concerns are biologists that would be willing and able to create a biological weapon for a terrorist group. Therefore, the focus of this paper is on scientists with that capability. Infectious disease specialists, aerobiologists, doctors, nurses, and scientists with training and the ability to culture infectious pathogens are included in the data sets. While some may argue for a higher standard of education and training for inclusion, saying that a PhD and extensive culture work would be necessary to lead a successful large scale BW program, the evidence in the history of bioterrorism argues for the lower bar. While nurses or college students may not have the skills to perform large scale military grade dissemination, they have led smaller scale bioterrorist attacks that are included in the sample.

Narrowing the sample set to such specific skills, this study assumes that a terrorist group would have different recruitment processes and criteria when choosing someone for a suicide mission and for a delicate technical project. Although the scientist’s skill set distinguishes him from the masses and qualifies him for a BW related project, it seems reasonable to assume that some
scientists are more likely to participate in terrorist activities than others. As mentioned above, this paper hypothesizes that the path highly educated scientists take to violent extremism will be significantly different than that of the average terrorist. As of now, the non-proliferation community has not yet come to agreement on what factors make a scientist more prone to terrorist activity and very little, if any, research has been done on the topic.

Threat reduction groups generally do not have access to the full backgrounds of the individuals whom they are assessing. Currently, even if the threat reduction programs come into contact with pertinent background information on biological scientists, the pertinent radicalization analysis needed to prioritize those individuals has not been completed. If patterns can be identified from past cases, identifying how life scientists are radicalized and recruited, then WMD Threat Reduction groups in the U.S. Government can focus their engagement on scientists most likely to be radicalized by terrorist groups to misuse biological agents. While globally, the overwhelming majority of biological scientists have altruistic intentions for their scientific work, history shows us that some individuals will always attempt to misuse available technology for nefarious purposes. In order for U.S. non-proliferation efforts to succeed, it is vital they have a more accurate profile of scientists. This information will aid the engagement process and attempt to steer these scientists away from radicalization.

For the purposes of this paper, someone who has been radicalized is an individual who has completed the pathway to violent extremism. These individuals have embraced a radical ideology to the point that they are prepared to commit a violent action. It is unclear whether the type of action that an individual perpetrates is based upon their level of commitment, their
circumstance, or some combination of factors. One of the data sets studied is life scientists who have the skills to commit (or at least contribute to) a bioweapons attack, and yet chose to perpetrate a conventional terrorist attack. While it may be that their circumstances were simply not right to be involved in a BW program, or they did not happen to think of BW, if any of the factors being examined differ in a statistically significant way, that information would be valuable to those working and engaging with scientists. It may give a warning signal of individuals willing to commit an act of biological terrorism.

Based on past biocrimes and bioterrorism events, it is clear that biologists are more likely to become terrorists than terrorist are to become biologists. Out of 180 events recorded in Seth Carus’s chronology of bioterrorism and biocrimes the overwhelming majority of the perpetrators had previous experience with the biological sciences. This may be an issue of difficulty and time; it takes a significant length of time to train as a biologist. Another issue may be that people use the skill set they have at hand, and non-biologists may not consider using BW as quickly. Terrorist leaders who use the rhetoric that they ‘would like to use BW’ but do not have the background, have tried to recruit sympathetic individuals that already have the technical training rather than wait the years it would take to train a biologist who was already a trusted comrade. This path is an expeditious effort because life science and infectious education and training are fairly common and not regulated.

**Literature Review**

In response to the demands of the policy community for radicalization factors, and an explanation of why after the September 11th attacks, many interdisciplinary newcomers to the
field theorized about which factors might influence individuals towards radicalization, building upon the significant body of work by radicalization scholars over the past fifty years. This section reviews the prominent literature in the field of radicalization to determine which radicalization factors are appropriate for inclusion in this study. Prominent radicalization scholars that will be reviewed include Marc Sageman\(^9\), Peter Nesser\(^{10}\), and John Horgan\(^{11}\). A number of other scholars focused on specific types of terrorism or radicalization factors will also be examined. Previous attempts at profiling the terrorist community are discussed in order to identify gaps this study can fill and avoid problems that hindered other authors. The radicalization factors that have been selected for this study are:

- Involvement in Institutions
- Age
- Discrimination
- Political and Humanitarian Motivations
- Social Recruitment
- Socioeconomic Background
- Education Level
- Country of Residence
- Country of Ethnicity
- Studied in the West
- Personal Trauma
- Gender
- Marital Status
A number of radicalization experts agree that creating a profile of a terrorist is next to impossible and that the large sample studies which have attempted to do this have failed. One major problem with past studies has been the attempt by the study to create a profile for all terrorists or all violent terrorists. Due to the cultural, geographic and motivational chasms between terrorist groups, it is unlikely that scholars will ever be able to identify a single “profile” or even coherent trends that apply to the global pool of terrorists. Kruger supports the notion that political violence is too broad of a category to generalize about. This study, which focuses on a subset of individuals with specific technical skills, is a new approach to narrowing the focus of terrorist profiling. Finding information detail about the lives of individuals that are wanted by government authorizes is another hindrance to terrorism research. The most detailed information available to the public will often be on individuals who have been caught and are being prosecuted.

Some of the first profiling attempts directed at the terrorist community focused on identifying a personality profile. In order to identify a “terrorist mindset”, initial presumptions were that the “mindset” would be mentally ill. This was quickly shown to be a fruitless exercise. Scholars could not identify a single terrorist personality, and an inordinately small percentage of the terrorist community was clinically mentally ill. In the next generation of terrorist profiling efforts, the German Ministry of the Interior published the background and psychoanalysis of 250 German terrorists in the 1980’s and Russell and Miller’s work in 1977 that profiled 350 European individuals. By focusing on a more specific subset of individuals, they were able to draw out more concrete trends. They saw that terrorist groups screened potential members and so terrorists tended to be relatively well educated. The subject’s high socioeconomic standing was
also notable given the links often drawn between terrorism and poverty. Marc Sageman’s work on a large data set of Al Qaeda militants\textsuperscript{21} was a significant contribution to the field, especially since Al Qaeda is America’s highest terrorist threat.

Kim Cragin’s testimony to the House Homeland Security Committee, Subcommittee on Intelligence, Information Sharing and Risk Assessment\textsuperscript{22} gives an overview of the process of radicalization that individuals go through to become part of a terrorist group and commit a terrorist act. The stages are ‘availability’, where individuals are sensitized to radical views and ideas; ‘recruitment and indoctrination’ where recruits are trained, often in seclusion to follow group ideals and learn to perform tasks; and ‘commitment’ where a crime or terrorist action is actually committed. As Dr. Cragin elucidates on how this process can be disrupted and defeated, it becomes clear that the main gap in current understanding is how to best prevent individuals from moving into the recruitment and indoctrination phase. Due to the fact that there is such diversity moving into this phase, this study explores possible functional mitigation measures by looking at a specific group at risk for radicalization and examining them based on a set of radicalization factors.

While the international security community agrees on some radicalization factors, others are disputed and the importance which some factors play seems to vary based on situation. While authors since the 1970’s have understood that there was not a direct causal link between objective poverty and terrorism, the vast majority still examine it as a factor because of the permeation through the political community of the poverty/terrorism linkage. Hudson\textsuperscript{23}, Wilkerson\textsuperscript{24}, Crenshaw\textsuperscript{25}, Hubbard\textsuperscript{26}, Russell and Miller\textsuperscript{27}, Gurr\textsuperscript{28} and Sageman\textsuperscript{29} all discuss
socioeconomic status in some form and most concur that relative deprivation and the frustration it breeds rather than poverty itself may have some link to terrorist radicalization.

Binary facts about the subject’s lives such as gender and marital status are included in the work of Sageman\textsuperscript{30}, and Hudson\textsuperscript{31}. While factors of this nature contribute to general understanding of how a typical subject appears, and present an easy target for information gathering, they do not generally produce useful analyses. Data for these factors varies widely between types of terrorist group, and while males are more likely to join terrorist groups than females; marital rates are often similar to population norms.

Educational and occupational markers have also been a fascinating point of examination for authors like Sageman who notes that a high percentage of terrorists in his data were university educated.\textsuperscript{32} Gambetta and Hertog’s ‘Engineers of Jihad’ article is probably one of the most controversial articles relating to the educational and occupational trends of terrorists due to the fact that it selects a specific profession and tries to identify the reasons engineers are so prevalent among Islamic Fundamentalist groups.\textsuperscript{33} Adding to the controversy, the article has been sensationalized and misrepresented by several media outlets. The article concludes that engineers are over-represented in Islamic extremist groups to a statistically significant degree. Gambetta and Hertog theorize that this phenomenon is realized based on a particular ‘mindset’ that makes engineers a good match for Islamism and the frustrating social and political conditions in many Muslim majority countries. Thomas Hegghammer’s “Terrorist Recruitment and Radicalization in Saudi Arabia”, examines how Saudi men were recruited to fight in Afghanistan and join Al Qaeda in the Arabian Peninsula.\textsuperscript{34} Counter to this phenomena,
Hegghammer found in his research, that among Saudi terrorists there were almost no engineers, doctors or scientists; which does not follow the pattern of Islamic fundamentalism found throughout the rest of the world. The presumed cause is the fact that highly educated individuals in Saudi do not face the same career advancement frustrations as individuals in other countries.

Violence, crime and conflict in all their forms, are thought to contribute to terrorist radicalization.\textsuperscript{35} Wilkenson\textsuperscript{36} links the presence of ethnic, ideological and religious conflicts to the radicalization of youth. However, he does not adequately address whether the conflicts are a root cause, or whether the same factors are driving both the conflict and radicalization. David Hubbard, in a detailed analysis of airplane hijackers in the 1970’s concluded that one of the aspects that most of the hijackers shared were violent pasts.\textsuperscript{37} Their pasts included both violence perpetrated by the subjects and against them. Psychologist Rona Fields claims that exposure to violence as a child can lead to a proclivity for violence as an adult.\textsuperscript{38} Speckhard examines Chechen suicide terrorism, but many of the factors she identifies can be extrapolated as risk factors for terrorism in general.\textsuperscript{39} Severe trauma, particularly violent trauma in the individuals past was identified as a factor common among the subjects. Violence seems to contribute to general vulnerability and is also a risk factor for youth being recruited by cults.

In order to answer the question, ‘Are life scientists radicalized and recruited to terrorism in different ways than traditional terrorists?’ and to fill in the gap outlined in the current literature outlined above, this paper investigates the backgrounds of a number of life scientists. The cases of terrorists who carried out or helped plan conventional attacks that were life scientists are compared to cases of attempted biological terrorism. The presence of radicalization factors in
the above groups is compared within the groups and to terrorist actors as a whole. Actionable trends that should inform non-proliferation scientist engagement groups have been identified.

**Methods**

In order to address the hypothesis for this study, the backgrounds of scientists will be compared to radicalization factors. A wide range of radicalization factors has been identified from academic radicalization literature. Each case is examined to see which radicalization factors are involved. Factors such as a history of severe trauma, employment, and country of origin are examined for their effects on scientists. The data are examined within each radicalization factor to determine which radicalization factors play a role in the radicalization of the two separate data sets relative to each other and relative to the general terrorist community. Additionally, the data are cross examined to determine the variance and similarities between cases. The focus is attempting to discern any variances between the bioterrorist data set, conventional terrorist data set and general terrorist population. The variances are analyzed to determine if any particular factor or combination of factors predominately contributes to scientist participation in violent terrorist activity. The analysis does not involve a statistical approach. This study identifies trends that should be examined further through larger data sets and more complex statistical tools.

The data in this project is composed of the backgrounds of individuals who have participated in biological terrorism and terrorists who have biological science backgrounds. Case studies of bioterrorism incidents, including detailed backgrounds of the perpetrators, have been thoroughly covered in the academic literature, most notably in the works of WMD historians.
Seth Carus and Jonathan Tucker. Their detailed presentation of these incidents serves as the main source of data for the bioterrorism section. The terrorist incident data is drawn from terrorism databases, law enforcement case studies, terrorist publications containing interviews and profiles, media coverage of the incidents, and other academic research that provides understanding into the backgrounds of terrorists.

Plots that possessed capability and intent for BW but ran into implementation problems and thus were not successful (such as Aum Shinrikyo) are included because the incidents involve the radicalization of someone with the appropriate expertise. Although the argument that if the terrorists had possessed the appropriate expertise they would have succeeded, has some validity; it seems that many of these bioterrorist plots met failure at the dissemination stage, which requires some engineering expertise.

The data set for this project includes life scientists or biological scientists and incorporates the specialties of aerobiology, infectious disease specialists, doctors, nurses, and individuals with scientific training and the ability to culture infectious pathogens; who have also committed to a violent terrorist act. Selection of the subjects is based upon their scientific knowledge and participation in a process with the intent to kill or maim large groups of people; rather than trying to select the individuals who actually disseminated the agents. Biological scientists are a group with many characteristics distinct from the general populous, based on their specialized skills and often odd personality traits; it may be worthwhile to examine them as a separate group from other radicalization candidates. While physicians do not always spend time in the laboratory, they meet the project’s basic criteria because of their thorough
understanding of infectious diseases. Even if culturing agents is not a large part of a physician’s job, it is reasonable to assume that it is within their skill set because of their work in the health community and required university coursework. Also, as a part of the health community, most health workers have easy access to the equipment, expertise and agents necessary to culture pathogenic organisms.

Eighteen subjects have been chosen for this study on the basis of their expertise in the life sciences, their participation in violent extremism and the availability of information about them in English. It was important to choose subjects where information about most or all of the radicalization factors was known. This selection process may have biased the second dataset towards individuals living in or attacking English speaking nations.

Nine individuals have been selected that participated in biological terrorism programs. The groups include Aum Shinrikyo, the Rajneeshee’s and Al Qaeda’s BW program. Ayman Zawahiri is included in the Al Qaeda section, although he did not physically perform any of the research for the program, he is an eligible sample because he had the scientific expertise to participate and made the moral choice to be administratively involved with the program.

Nine individuals were selected that are qualified in the biological sciences and chose to commit a conventional terrorist act. While there are other individuals that could have been chosen for both sample sets, the decision to focus on these individuals was made based largely on the availability of information. This may prejudice the sample sets towards individuals that have garnered greater attention from the western media, but it was important
to select individuals with as much background data as possible for a useful analysis to be performed.

This paper will first research applicable literature to gain a thorough understanding of the knowledge base on each of the selected subjects. Specific factors on each are then gathered and organized for comparison and trends. Trends between the data set of bioterrorist actors, conventional actors, and the general population will be analyzed. Lastly, conclusions will be drawn to provide the threat reduction community some guidelines on characteristics that assist in the screening and identification of potential threats.

**Bioterrorist Data Set**

Following is biographical information for the group of nine scientists that attempted to create biological weapons. This information will be organized and presented by radicalization factor in the next section.

*Aum Shinrikyo*

Aum was a Japanese cult that followed the half-blind cult leader Shoko Ashara and wanted to bring about the end of the world with unconventional weapons. While there were many members of Aum that had medical experience, the scientists that participated directly in the weapons program are described below. Aum was founded in 1984 and attacked the Tokyo subway system with Sarin gas in 1995; the group had a biological weapons program but never completed a successful deployment.40
Hideo was born in 1954 in Japan; he was a PhD astrophysicist who joined Aum Shinrikyo in 1987 with his wife. As a child Hideo was known as extremely withdrawn, but a brilliant student. He was also notably compliant with authority. Hideo never missed a day of class and always wore a school uniform although not required. Prior to joining Aum, Hideo had a prestigious job at Kobe Steel Company. His decision to join Aum was apparently a product of his devotion to Ashara and his desire to transcend the ordinary through the supernatural. He rose quickly within Aum and soon became their chief scientist (his official title was Minister of Science), thereby putting the cult’s bioweapons efforts under his direction.

Murai was apparently an extremely devoted follower of Ashara, and was something akin to his second in command. Murai was noteworthy even among other cult members for his complete subservience to Ashara, even to the point of recognizing Ashara’s scientific prowess over Einstein. With the leadership position Murai held he had the power to put into place a number of absurd schemes that can best be described as hare-brained; including weather manipulation, microwave weapons, artificially-induced earthquakes, brain wave head gear and giant plasma weapons. In
addition to these eccentric experiments that did not pan out, he is suspected to have been involved in the murder of a lawyer (who was representing Aum victims) and his family and the Tokyo Sarin attack. Murai was killed in 1995 by a Yakuza gang member hitman in the aftermath of the Sarin subway attack.  

*Seichi Endo*

Endo is a veterinarian that also pursued virology studies at Kyoto University before joining Aum in 1989 at the age of 28. The combination of these skills made him highly qualified to work on a program acquiring and producing bacteria and viruses. Endo was always a serious, bright student who was very religious. Despite being a good student, Endo seemed somewhat famous for his scientific failures within Aum. He produced an extremely impotent and impure form of Sarin. While Endo was qualified as a scientist to acquire and produce pathogens, nothing in his training prepared him to disseminate pathogens. Dissemination was an area where Endo and Aum as a whole failed, apparently due to the lack of recognition that a different, engineering focused expertise was needed for this task. Endo also suffered from grandiose ambitions, he ordered advanced equipment for his lab that neither he nor
anyone on his staff knew how to operate. It is presumed he had the appropriate
training to produce large amounts of agents through basic methods, had he kept his
processes simple.\textsuperscript{43}

\textit{Masami Tsuchiya}

Tsuchiya was not the leading scientist at Aum, but was widely known as its most
successful and talented scientist. Masami joined the cult in 1989 at the age of 24, just
after his graduation from graduate school at Tsukuba University where he pursued a
doctoral degree in Organic Physical Chemistry. During his time at school Tsuchiya
was introverted, lived in a barren room and discussed becoming a priest with fellow
students.\textsuperscript{44} When Masami first encountered Aum and showed enthusiastic interest in
the organization his parents attempted to have him committed, but he ran away to join
Aum anyway. Masami was one of the few Aum inductees to graduate from a
prestigious science university.\textsuperscript{45} According to excerpts from his diary he constantly
thought about Aum taking over the Japanese government and then expanding all the
way to Jerusalem. He was noted to be very spiritual, sometimes skipping weapons
work to stay in meditation. Even while in prison, Masami did not give up his beliefs in
the cult or the guru. Based on his erratic behavior during his trial, Tsuchiya is often thought to have had psychological issues. Tsuchiya’s death sentence was recently finalized by the Japanese court system.

RISE

RISE was a group started by Allen Schwandner in 1971 that aimed to wipe out the human race and start over with the 16 members of the group. The group’s basis for wanting to reconstruct society was the fact that mankind was destroying itself and the planet. Chicago police busted RISE in 1972 before they had a chance to begin their plan to cleanse the world, which would have started with poisoning the Chicago water system with biological agents.46

Stephen Pera

Stephen Pera was arrested at the age of 18 in 1972 by the Chicago police for his involvement with RISE, and for his plots to contaminate the city’s water system. Pera was living with his parents at the time of the plot; his father was a school principal. Pera was the first recruit to RISE in 1971, and was the right hand man of leader Allen Schwandner. Pera had a relatively easy time gaining the knowledge, equipment and agents needed for his attack on the water system due to the open nature of information
prevalent in the biological sciences community. All of his queries about information and material were initially considered to be the innocent interest of a gifted student.

Those who worked with Pera both inside and outside of RISE considered him to be a genius, or at least extremely gifted, although he was new to microbiological techniques and had little formal training. Pera participated in a community college microbiology class and a micro work study program, but dropped out of both. The college courses, he claimed, were not challenging enough for him and he left the work study because of disagreements with other students. After these half-hearted attempts of training, Pera became a volunteer in the laboratory section at a local hospital. While Pera showed the appropriate level of understanding and ability to culture a variety of pathogenic agents, his (and RISE’s) fatal flaw seems to have been the lack of understanding of the fundamentals of agent dissemination. It seems highly unlikely that RISE’s plan would have been successful, had they been able to carry it out, even though they did have sufficient quantities of pathogenic organisms to merit a credible threat.\textsuperscript{47, 48} Since they did not have the requisite understanding of biological agent dissemination, both of their dissemination schemes would have failed, even if time had been available for Pera and Schwandner to carry out their plans.

\textit{Rajneeshee’s}

The followers of Bhagwan Rajneesh started their cult in India in the 1960’s and relocated to a ranch in Dalles, Oregon in the early 1980’s. Initially, they began on a ranch, living a quiet
worshipful lifestyle, but soon attempted to take over the town politically and planned to use biological weapons as a tool to prevent most of the town from voting in a local election.\textsuperscript{49, 50}

\textit{Ma Anand Puja}

Was born in Manila in 1947 as Diane Ivonne Onang, and grew up in California.\textsuperscript{51} She became a registered nurse in California in 1976 and trained at LA County Hospital\textsuperscript{52}. In the years following her certification, Puja claims to have worked in clinics around Asia including the Philippines and Indonesia from 1977-1979,\textsuperscript{53} but in other interviews she claims to have been the director of Kern Country Medical Center for several years during the same period\textsuperscript{54}. Whatever the case, she was in India in 1979 where she came into contact with Rajneeshees. She joined the cult in 1979 and became director of the Rajneesh health center in 1980. Puja was one of the group’s few “inner circle members” and held a great deal of power in the group, including full control over all medical facilities.\textsuperscript{55} Puja was feared and disliked by many on the compound, who described her as tyrant and compared her to Nazi concentration camp doctors.\textsuperscript{56} Her one close contact was Sheela, the defacto leader of the ranch. One cult
member recalled that Puja “delighted in death, poisons, and the idea of carrying out various plots.”

Puja was able to legally order the bacteria and equipment she needed to poison the town as legitimate medical supplies for the clinic/laboratory she managed on the ranch. In addition to the salmonella used in the plot against Dalles, Puja acquired a number of other more serious agents including *Franciscella tularensis* which could have caused a significant death toll if disseminated. These agents, and other equipment like a lyophilizer (freeze dryer), were not necessary for RMC’s work as a diagnostic laboratory, but have clear weapons implications. After the break-up of the cult, members claimed that they had witnessed Puja’s lab assistants catching mice around the compound for her to test biological weapons on in the lab. While this may show intent to assure that weapons produced the desired negative effects, catching and using wild mice in lab experiments doesn’t show very much scientific rigor and may be evidence of traditional academic laboratory training.

*Al Qaeda*

Al Qaeda’s biological weapons program was code named Al Zabadi, Arabic for curdled milk. AQ wanted to use bioweapons, primarily anthrax, to cause mass casualties in the United States. Ayman Al Zawahiri, Bin Laden’s right hand was in charge of the AQ’s biological weapons efforts. Al Zabadi was disrupted with the U.S. invasion of Afghanistan in 2001.
Rauf Ahmed

(no picture available)

Rauf Ahmed is also known as Abdur Rauf, and maintained a number of aliases during the time he collaborated with Al Qaeda and Ayman Al Zawahiri on a biological weapons program. Ahmed is a Pakistani biologist that was working for the Pakistani government before he was recruited by Ayman Zawahiri in 1999. Rauf is currently 52 years old and is thought to be free in Pakistan. Rauf’s main responsibilities as assigned by Zawahiri were to equip a biological laboratory and obtain pathogenic strains of organisms of interest to Al Qaeda. As a microbiology PhD with a focus in food production, Rauf was technically equipped to set up a laboratory and grow bacterial cultures, but had little to no familiarity with the pathogenic organisms suitable for biological weapons use when he started this project. When he was recruited, Rauf was working at the Pakistan Council of Scientific and Industrial Research (PCSIR), in Lahore, Pakistan. Based on a 2004 publication on rice toxins by the Pakistan Academy of Sciences, indications are that he is still employed there.

Rauf was a member of the international Society for Applied Microbiology and attempted to use those, and other contacts to obtain the bacteria strains he needed. Due to the dual use nature of biological laboratory equipment, Rauf had no trouble obtaining fermentors and incubators (used to grow bacteria), respirators and vaccines (safety equipment) and other basic equipment for his laboratory. Rauf was introduced to an Al Qaeda member by a colleague who was aware of his extremist sympathies, he was later introduced directly to Zawahiri, and the two collaborated on the Al Qaeda
bioweapons effort from 1999 to 2001.65,66,67 In his communications with Zawahiri, Rauf consistently commented on funding issues and his ideology (which may be less extreme than Zawahiri’s); a combination of which led to a weakening of the trust that Zawahiri/AQ had in Rauf.68,69

Yazid Sufaat

Sufaat is a Malaysian bioscientist, born in 1964, who studied at California State University (some sources say California Polytechnic State University).70,71 Sufaat received a bachelor’s degree in Clinical Laboratory Technology at CSU, which would have provided him some laboratory skills, but without a PhD, he would not be ideally qualified to lead a biological weapons program. However, this may indicate the priorities of AQ leadership tending to value the qualities of a more committed member with less education, over someone with more education. Sufaat returned to Malaysia to become a laboratory technician in the Malaysian Army from 1987-1992. When Sufaat returned from his western education, his family, and particularly his mother-in-law, disapproved of how secular he had become. This reaction apparently led Sufaat to return to praying regularly at the mosque, where he came into contact with Riduan
Isamuddin (Hambali), a high ranking Jemaat Islamiya member. Sufaat joined Jemaat Islamiya (JI), an Al Qaeda affiliate, in 1993.\textsuperscript{72} After joining JI, Sufaat travelled to Pakistan for more religious training and completed his recruitment into JI.\textsuperscript{73}

As a full-fledged member of an Islamic fundamentalist group, Sufaat was trusted by AQ leadership to a greater degree than Rauf Ahmed. After meeting Hambali, Sufaat founded his own clinical pathology laboratory named Green Laboratory Medicine (in 1993), which was used as an AQ front for a number of activities in the years to come, including attempted BW production. Sufaat often held JI meetings at his home in Kuala Lampur and allowed Islamists to stay with him as they passed through town; with the knowledge and apparent support of his wife.\textsuperscript{74} Once he joined JI, Sufaat’s job and social life all seemed to revolve around the group.\textsuperscript{75} In August of 2001, Zawahiri and Hambali met for a week with Yazid Sufaat to discuss the bioweapons program. During this meeting Sufaat reportedly told the leadership that he had successfully isolated a “lethal strain of anthrax”.\textsuperscript{76} Sufaat is thought to have worked on the AQ bioweapons program near Kandahar in 2001 until his return to Malaysia in December of that year. Sufaat is currently at large in Malaysia.
Ayman Al Zawahiri

Osama bin Laden’s top lieutenant, and leader of the controversial Al Zabadi chemical and biological weapons program, Ayman Al Zawahiri is one of the most controversial terrorists in the world. Ayman was born in Giza, Egypt on June 19, 1951. He was involved with Egyptian Islamic Jihad before becoming involved with Osama bin Laden and Al Qaeda. Zawahiri is a Cairo University trained surgeon emanating from a powerful Egyptian family. His father was a doctor and a professor of pharmacology at Ain Shams University, and many other members of his family were involved in the medical profession. The family also includes a number of prominent Al Azhar scholars including Mohammed Al Ahmadi Al Zawahiri. In addition to being a doctor himself, Zawahiri had extensive connections in the Arab academic world with other doctors, scientists and engineers. While he was a part of the Egyptian Islamic Jihad, Zawahiri was still active in the community and in public institutions. After he travelled to Pakistan in 1980 to take part in the jihad as a doctor and became more involved in the international jihad, Zawahiri began to withdraw from public life.

Ayman was always considered to be an extremely bright student, and was at the top of his class all the way through medical school. He was described as quiet and introverted
by his classmates, a dreamer. His family had noticeably less money than others in the wealthy expat neighborhood of Maadi where they lived. At 15 Zawahiri formed a cell dedicated to the overthrow of the Egyptian government.\textsuperscript{79} Ayman continued his Islamist activities against the socialist Nasser and Sadat regimes, under the radar, and without violence. He set up his surgery practice and married Azza Nowair, from another family in Maadi in 1978. Ayman and Azza have three daughters. After his marriage Ayman spent many years in the Afghanistan/Pakistan border region fighting the Soviets. He seems to have become a hardened radical and committed to violence after he was held and tortured in an Egyptian prison. Zawahiri was in prison from 1979-1982 following the assassination of Sadat by Islamic radicals. Once Zawahiri became closely involved with AQ and Bin Laden, he led Al Qaeda’s biological weapons effort. He pushed the idea with AQ leadership, recruited scientists and administratively directed the effort.\textsuperscript{80,81}

\textit{Midhat Mursi Al Sayid 'Umar (Abu Khabab)}

Abu Khabab is the notorious Egyptian that led biological and chemical weapons training, research and testing at camps in the Afghanistan/Pakistan border region.\textsuperscript{82} He was born on April 29, 1953, and worked in the Afghan training camp Darunta.\textsuperscript{83}
writing manuals, training others and performing research on crude biological and chemical weapons.\textsuperscript{84, 85} Midhat grew up in a crowded neighborhood of Alexandria, Egypt, and attended Alexandria University to obtain a bachelor’s degree in Chemical Engineering. After his graduation in 1975, Midhat became involved with EIJ (Egyptian Islamic Jihad). He was arrested in the 1980’s for his participation in an Islamic organization after the assassination of Anwar Sadat. Midhat left Egypt in 1987 and travelled to Saudi Arabia, from there he made his way to Afghanistan to join the jihad.\textsuperscript{86} Around the time he left Egypt Midhat married a Pakistani woman, they later had two sons, Mohamed and Hamza.\textsuperscript{87} Once Midhat was working at training camps in Afghanistan he did not have significant interactions with community institutions, although he was in contact with his immediate family.\textsuperscript{88}

**Terrorist Data Set**

Following is biographical information for the group of nine scientists that attempted to perpetrate conventional terrorist attacks. This information will be organized and presented by radicalization factor in the next section.

*Afia Siddiqui*
More famously known as “Lady Al Qaeda”, was born on March 2, 1972 and was sentenced to 86 years in prison this year for weapons possession and attempted murder. In 2008 she was apprehended in Afghanistan with dangerous chemicals, bomb plans, and a list of targets inside the United States. While she was being questioned, she shot at a number of American officials present. No one was injured except Siddiqui, who was shot in the stomach.\textsuperscript{89} Siddiqui reportedly trafficked diamonds and other gems for AQ from Liberia to Pakistan in June of 2001.\textsuperscript{90}

Siddiqui was born in Pakistan and attended MIT after studying one year at the University of Houston for her undergraduate degree in Biology. She was a bright student and won a grant for independent study in her sophomore year. During her trial it came to light that she took a target shooting course as a young MIT student. After being awarded her bachelor’s degree, Siddiqui attended Brandeis for her graduate degree in Cognitive Neuroscience. During this time she continued her religious devotion, distributing Korans at prisons and schools. According to her Imam in Boston she was focused on helping the less fortunate and was frustrated that other Muslims did not do so.

After 9/11, Aafia and her husband returned to Pakistan, saying that it had become too difficult to live as Muslims in the U.S. Her husband at the time was Ammar Al Baluchi; they later divorced when she was pregnant with their third child. Ammar was an anesthesiologist at Brigham and Women's Hospital in Boston, where the couple, along with their children lived. Aafia’s family is also quite accomplished; her brother is an architect and his wife a pediatrician. Her sister studied neurology and her father was a
physician. Unlike many terror suspects, Aafia was not isolated from her immediate or extended family, or her friends in Boston. To those who knew her she was a quiet, kind and religious figure. Siddiqui has three young children, two of whom are currently missing. Human rights groups claim they may be held by Pakistani forces. Many aspects of Aafia’s life are disputed, and there are large gaps. She appears to have been missing from 2003-2008. There are also differing accounts of who she was married to, this may stem from the fact that she was divorced and remarried.

*Rafiq Abdus Sabir*

Dr. Sabir, born in 1955 in New York, was an emergency room physician in Florida when he offered his medical expertise to a terrorist group. The FBI had infiltrated the group that he offered to support, and was present at the ceremony where he swore his allegiance to Al Qaeda. Sabir was arrested in 2005 for his support of terrorist activity after a two year sting operation that focused on Sabir and his good friend in New York. When Sabir was pledging his allegiance to the undercover FBI agent, he offered to provide medical care for Al Qaeda operatives that were injured, not to commit violence. The fact that qualifies Sabir for this paper is that he and his colleague attempted to travel to Afghanistan training camps in 1998 to learn how to carry out violent attacks. Sabir was
sufficiently radicalized to violence by demonstrating he was prepared to train in violence.97, 98

Rafiq Sabir was born and raised with the last name of Wright in a Catholic family in New York. After his father left the family, Sabir spent a large portion of his childhood in state care, and during high school he converted to Islam and changed his name. Sabir attended City College for his undergraduate degree in Biology and later graduated from Columbia University Medical School in 1981 with a specialty in Emergency Medicine.99, 100 Sabir has five children, three of them from his first marriage. Sabir traveled back and forth to Saudi Arabia, where he worked as a doctor, to support his current wife Arlene Morgan and children.101 Neighbors in their Florida community noted that Sabir would dress in traditional Islamic clothing, and he was involved in the community through the hospital where he worked and the mosque he attended.102

Ali Al Tamimi

Dr. Tamimi was born in Washington D.C. on December 14, 1963 to Iraqi parents.103 He has been sentenced to life in prison for inciting, participating in training for terrorist
activities, and contributing services to the Taliban. Tamimi grew up in Washington, and his parents were well educated, though not scientists. His father was a lawyer and his mother was a psychologist.\textsuperscript{104} Ali’s family moved to Saudi Arabia when he was 15. While at high school in Riyadh, he was instructed by famed Salafist Abu Ameenah Bilal Philips. Tamimi studied at the Islamic University in Medina,\textsuperscript{105} and obtained a bachelor’s degree in Biology and a PhD in Computational Biology from George Mason University.\textsuperscript{106} He was considered a top scientist at George Mason, where he was at the cutting edge of computational biology.

In 1991 Ali married Ziyana Al Rawahi who was from Oman. Tamimi was deeply immersed in theological aspects of Salafism. His advocacy for violence seems to have grown from his fervor for this school of radical Islam. Like many academics, Ali’s passion for learning became a passion for teaching and passing on that knowledge to others. His fame as an Islamic preacher began to grow and he lectured on Islam around the world.\textsuperscript{107} In at least one speech Ali declared that “the destruction of Israel was a Koranic imperative”.\textsuperscript{108} Tamimi began to change after September 11, 2001, when the lines between the west and the Muslim Ummah began to solidify for him. In 2004 he was indicted for recruiting and training terrorists.
Dr. Rana was born in Pakistan on January 12th, 1961. He is currently a Canadian citizen who resided outside of Chicago with his wife Samroz Rana Akthar, also from Pakistan, until his arrest. He owns several businesses and has three children with Akthar Rana, his wife. Quiet, and introverted as a child; Rana grew up in Lahore where his father was a high school principal. Rana served in the Pakistani military’s medical corps, until he suffered a bout of altitude sickness when transferred to the North West Frontier Province (now the KPK). The military gave him leave to travel to the west for medical treatment and he never returned. In the small diverse community on the outskirts of Chicago where Rana resided, he was known for giving legal help to neighbors through the immigration business he owned. When a local free clinic was having financial troubles, Rana helped to raise money so they could stay open.

Rana is suspected of collaborating with David Headley, in plotting the 2008 attacks on Mumbai and attacks on the offices of Jyllands-Posten. Sources also claim he is an operative of Lashkar e Toiba. Both Rana and Headley attended the Hasan Abdal Cadet College in Pakistan in their youth. Rana and Headley travelled to Mumbai
in November 2008 to scout for the upcoming attack on Mumbai. The pair was also planning an attack on the Jyllands-Posten headquarters in retaliation for the newspaper publishing a cartoon of the Prophet Mohammed. Rana and Headley exchanged emails about the attack in January of 2009; they were arrested in October of 2009 for involvement in both plots. While Rana did not complete the act of killing anyone, he was a vital component of the slaughter of others. He was clearly radicalized to the point of violence.

_Bilal Abdulla_

Dr. Abdulla is a second generation Iraqi immigrant to Britain that was sentenced to 32 years in prison in 2008 for his attempts to set off car bombs in London. After two failed attempts to set off car bombs at other points in the city, Bilal and a colleague drove a vehicle born improvised explosive device (VBIED) into the airport, fortunately the explosives did not detonate. He was born in Aylesbury in 1980, where his father was training as a physician and his mother was a pharmacist. His family returned to Iraq when he was young, and he grew up in a wealthy suburb of Baghdad. Bilal graduated as one of the top students in Iraq from high school and went on to study medicine at the
University of Baghdad. After two years he transferred to Cambridge and stayed with relatives in the U.K.\textsuperscript{118}

Bilal was extremely upset by the Allied forces invasion of Iraq in 1991, claiming they had destroyed the country. This was heightened by the subsequent U.S. invasion of Iraq in 2003, which was the impetus for the terrorism plot for which he was ultimately prosecuted. Bilal was affected by both the political ramifications of Britain invading his country and by the humanitarian tragedy that had overcome his country. After the allied invasion in 2003, Bilal was back in Iraq and became obsessed with resistance to western forces, helping to start political resistance groups at the University of Baghdad. Bilal planned his attack on Britain after returning to London along with his Indian friend Ahmed. Bilal never married, much to the dismay of his mother, but he was in contact with his family until the attack. Bilal’s family does not approve of his actions and has made this clear in public statements.\textsuperscript{119}

\textit{Fathi Abd Al Aziz Shaqaqi}

Shaqaqi was a Palestinian born in Gaza in 1951 to a refugee family from Zarnouga.\textsuperscript{120} The family was all farmers for generations in Zarnouga before they fied
to a refugee camp. Fathi had seven siblings including Khalil Shaqaqi, a Palestinian Political Scientist. Both Fathi and Khalil received scholarships to attend university outside of Gaza, Fathi attended Beir Zeit University in the West Bank for a bachelor’s degree in Mathematics before moving to Zagazig, Egypt for medical school. He founded the Palestinian Islamic Jihad (PIJ) in 1979 when he was a medical student in Egypt. Fathi and other founding members joined the Muslim Brotherhood (MB) while they were in Egypt but decided to start their own organization because of what they viewed as MB’s “moderate stance” and to be able to focus on the Palestinian issue.

Fathi was expelled from Egypt in 1981 after the assassination of Sadat, and he returned to Israel. He practiced medicine at Mutalla Hospital in Jerusalem before returning to Gaza. Fathi was arrested for his political activities in 1983 and 1986 for his political activities by the Israeli authorities. The stated goal of PIJ is to form an Islamic Palestinian State, and violence is considered a legitimate means of achieving this goal. The founders also drew inspiration from the Iranian revolution. To this end, PIJ conducts suicide bombing and gunfire attacks on Israel, the West Bank, and Gaza Strip. Fathi can be held responsible for this violence because of his leadership role in the group, both as an ideological leader who motivated followers and also as a commander who had direct control over operations carried out. Fathi was the first Sunni leader to publish a booklet legitimizing suicide operations, and he is widely held responsible for the initiation of suicide bombings in Israel and the Palestinian territories. PIJ’s first attacks were a hand grenade attack against military
recruits in 1986\textsuperscript{129} and the killing of a member of the Israeli military in 1987.\textsuperscript{130} Unlike many other groups in the region, Fathi and the PIJ made little effort to develop a humanitarian side to their organization and gain a broad base of support. He felt that a string of spectacular terrorist attacks would motivate a popular uprising, and thus the group focused almost solely on violence as the means to achieve their goals.\textsuperscript{131}

Because of his activities with the PIJ, Fathi was expelled from Israel in 1988 and travelled to Lebanon where he had contact with Hezbollah.\textsuperscript{132} He was shot and killed by assassins in Malta in 1995. The general assumptions is that he was killed by Israeli agents, after being held responsible for several suicide bombings in Israel that year.\textsuperscript{133, 134, 135} While Fathi and PIJ never enjoyed the broad support of groups like Hamas, he was still popular in the community and currently has a gymnasium named after him.\textsuperscript{136, 137}

\textit{Abdel Aziz Al Rantisi}

Rantisi’s story has many similarities to Shaqaqi’s. He was a Palestinian born in 1947 who grew up in Khan Yunis refugee camp.\textsuperscript{138} The entire Rantisi family, which consisted of nine boys, two girls, and Abdel’s parents, lived in a tent in the refugee
camp. Abdel distinguished himself at school and graduated at the top of his class.\textsuperscript{139} Egypt was offering free tuition to exceptional students from Gaza at the time, and as a part of this program Rantisi attended Alexandria University Medical school from 1972-1976 to become a pediatrician. He was exposed to the Muslim Brotherhood while he lived in Egypt and joined them in 1976. After his return to Gaza he worked as the Head of Pediatrics, but was imprisoned for political activities several times.\textsuperscript{140} When the Islamic University in Gaza opened in 1978, Rantisi became one of their lecturers on the subjects of genetics and parasitology.\textsuperscript{141}

Rantisi was one of the founding members of Hamas in the 1980’s, Hamas views itself as the Palestinian branch of the Muslim Brotherhood. Although he spent several stints in prison for his involvement with Hamas, Rantisi continued to be connected to the group at a high level.\textsuperscript{142} Israel deported Rantisi to Lebanon in 1992 where he served as the spokesman for the organization. When Rantisi returned to Israel he was arrested and jailed multiple times. Until shortly before his ascension to power, Rantisi continued to be in contact with his family and lecture at the local university.\textsuperscript{143} Rantisi became the leader of Hamas in 2004 a few short weeks later he was killed by an Israeli missile strike.\textsuperscript{144}
A Cuban Pediatrician, Dr. Bosch was a leader in the Anti-Castro movement in South Florida. Bosch was born August 18, 1926 in Santa Clara, Cuba where he was raised as a Methodist. Bosch completed medical school at Havana University in 1946. Fidel Castro’s revolution in 1959 motivated many young men in Cuba including Orlando Bosch who sided with Castro until shortly after his victory. One account asserts that Bosch disagreed with how the new regime was dealing with war crimes. Bosch and a band of rebels fought for a short period of time in their home province, but he left Cuba in 1960 after a warrant was issued for his arrest. The trip was allegedly to collect money and weapons for his resistance, but Bosch travelled to the U.S. and never returned to Cuba. In the U.S., Bosch completed his residency in Ohio. He has been married twice and has children and grandchildren in South Florida, his current wife is Adriana Delgado, while his first wife, Myriam and children stayed in Cuba.

Bosch immigrated to the U.S. and was a part of the U.S. Government’s anti-Castro efforts that were developed among South Florida Cuban exiles. Bosch committed violent attacks soon after the change of Cuban regime in 1959, but his first known attack after moving to the United States was in 1963. He attacked sites in Cuba, ostensibly with CIA.
support. Bosch’s most famous crime was the bombing of a Cubana airlines flight that killed 73 people in 1976, but he committed a number of other bombings of ships and airplanes which were directed against the Cuban government and those who associated with it. Bosch is known as a freedom fighter in the Florida Cuban community and as a terrorist in most other communities. He recently released his memoirs entitled “Los Anos Que he Vivido” (The Years I Have Lived), in Miami.  

George Habash

Dr. Habash was a founding member of the Popular Front for the Liberation of Palestine (PFLP) and a pediatrician. He was born in 1926 in Palestine, and attended high school in Jerusalem, where his father was a store owner. After graduation George worked for two years as a teacher before starting at the American University of Beirut in 1944. Habash’s family immigrated to Lebanon in 1948; they left as refugees because of the war with Israel. This was a defining moment in his life according to Habash. He created the Arab National Movement in 1952. Habash started out by giving medical aid to Palestinian refugees but after the 1967 war, decided to take up violence in defense of his homeland. He started the PFLP in 1967, while at times he collaborated with some PLO factions; he was violently opposed to any agreements with
Habash had two daughters with his wife Hilda. At the age of 74 Habash gave up leadership in the PFLP, he passed away 8 years later.

**Radicalization Factors**

The following radicalization factors were selected from a review of the literature. Each is considered by at least one leading radicalization scholar to have a significant effect upon the radicalization of terrorists as a whole. Each radicalization factor is defined, and examined for its importance to radicalization. The factors’ presence in the general populous is discussed for reference, along with its prevalence in the wider terrorist community. Following these scoping discussions, the presence of each factor in the project’s two data sets is examined.

**Involvement in Institutions**

This factor gauges whether or not the individual in question is involved with their family and community institutions. Contact and connection with family members, neighbors, community members and work with community institutions will be considered as involved with the community. Communication or cohabitation with a spouse and children will not be counted as involvement, but interaction with extended family or parents will be. Parents and extended family are groups that can exert some pressure and control over the actions of an individual, while often a spouse is seen as subservient to the subject or an extension of themselves, and would not likely be a moderating force. Ties with community members and institutions expose radicalized individuals to more moderate views which may affect how radical their views become in relation to the general population.
An individual considered to be separated from institutions would conduct all their primary social interactions through the terrorist group in which they are involved. Many move to a camp or separate location to live with the group. They generally cease communication with extended family and have difficulty continuing in their profession. While individuals in society are always involved at different levels in the community, this criterion is attempting to identify individuals who have withdrawn completely from the life they had prior to radicalization.

Individuals may resist accepting the bonds of society for a number of reasons. Certain types of radical groups may be more likely to require their members to withdraw from society. Cults are notorious for pulling members out of community and cohabitating. Other radical groups may require this of inductees either because the extreme actions the group is involved in may not be accepted by the community, or for operational security to avoid detection by the government. Sageman notes that up to 80% of the Al Qaeda terrorists in his sample are in some way excluded from society. While not all the militants in Al Qaeda are a part of unconventional weapons programs, they are part of a group that does attempt such activities and requires a high degree of secrecy and isolation from the community around them.

Whether withdrawal from society is a driver (groups pull away in order to commit more extreme acts), or a product (once they pull away the group has no moderating influences and becomes more extreme), groups and individuals that operate outside
the constraints of society are more susceptible to increasingly extreme actions. Due to
the moral and societal constraints imposed on the use of unconventional weapons,
individuals operating outside those constraints would be more likely to create and use
those weapons.

**Age**

The age of radicalization and the age when the individual in question is radicalized to
violence are examined in this section. The age of radicalization is when the individual
shows sympathy or involvement with extremist elements. This threshold does not
meet the definition of violent radicalization set by this paper, but aims to identify
when an individual began down the path of radicalization. Because the process can
begin gradually and is not always outwardly evident, this data is less concrete than
much of the information in this paper. For the purposes of this project, the age of
radicalization is generally set when an individual was said to have joined a politically
radical group, began associating with known extremists, or began espousing radical
views.

The age of being radicalized to violence is when the individual has crossed a mental
threshold by demonstrating a willingness to harm others in the pursuit of their radical
views. For many of the individuals this is the age they were when they participated in
their first or only attack. But in other cases, when the dates the subject began to plan
for an attack are available, they are used. Other instances when the exact date of the
violent action won’t be used include when the individual was arrested prior to the
attack, in which case either the planning dates or the date of the arrest is used for this threshold. Lastly, this paper uses an age where a subject shows a willingness to commit violent action by attending an extremist training camp. Leaders that are not directly responsible for attacks are nevertheless considered responsible for attacks they have supervisory control over; and so leaders are considered radicalized to violence when attacks are known to have occurred under their supervision. Ages in this section are approximations based on years and are not calculated to the month, given the lack of precise data for most events.

In terrorist literature the average age range of young men that are radicalized is 18 to 24.\textsuperscript{156} It is not possible to have a complete or even a representative sample of terrorists to work with, but some conclusions can be drawn from the work of Marc Sagemen. Sageman, who looked only at Salafist jihadi’s, and divided them into three waves. The first he describes as those who fought in the Afghan jihad with bin Laden; other ethno nationalist groups from a similar time period could be included in the “first wave” archetype. The second wave was composed of successful young men from across the Middle East, and was the focus of Sageman’s research. These men were typically middle class, well educated; the average age for this group to make a commitment to violent jihad was 26.\textsuperscript{157} Sageman’s third wave was composed of second and third generation immigrants to western countries; this group was typically less well educated, younger, and averaged the age of 19-20.\textsuperscript{158}
Discrimination

Religious or ethnic discrimination and the subsequent frustration on the part of the subject is the focus of this factor. Discrimination from a governmental body or from members of society will be counted. In some cases, the political situation of the country an individual is living in is a clear indication that they were subject to ethnic or religious persecution of some manner from authorities. In other cases specific instances of discrimination were recorded in the literature. When the subject describes feelings of injustice or frustration at discrimination by the government or society, that case will also be counted as a positive indication of discrimination. When none of these indicators appear in an individual’s history that will be considered ‘No indication of discrimination’.

Discrimination is an important factor to consider because the vast majority of terrorist groups are fighting to resist a government or power, greater than themselves that they perceive has visited some injustice upon them. Traditionally this injustice is along religious or ethnic lines. It seems rational to assume that individuals who had personally experienced this injustice would be radicalized faster and to a greater extent than those that had second hand knowledge of co-religionists or co-ethnisists being persecuted. This type of injustice is often listed in first-hand accounts from terrorists as the reason that their frustration grew, and the reason they felt such solidarity with their religious or ethnic group. If this is not the case, the way in which humans identify with the suffering of others needs to be further examined.
Political and Humanitarian Motivations

All the individuals in the data sets of this study have either political or humanitarian frustrations, or both which led them to commit violent actions to achieve their goals. Political motivations include frustration with government because of corruption, a failed or weak state, a foreign power or occupier present, lack of civil liberties, lack of democracy. The pursuit of political goals as the primary focus of the individual is also coded as the individual having political motivations. While all terrorists actions by definition on some level have ties to politics, some individuals make clear with their speech and action that their primary goals are social and humanitarian and they have resorted to terrorism to achieve their goals.

Individuals will be counted as having political motivations if their rhetoric was aimed at the destruction of another government or society, or if their actions were designed to bring about political change in their own or another government. Subjects will be counted as having humanitarian motivations if it is clear from their rhetoric and actions that their primary concern was the cessation of violence against a particular group. While using terrorism to attempt to end violence may be ill advised, rage against the abuse of civilians is a gateway for some along the pathway to terrorism.

Social Recruitment

Social recruitment is a personal connection to someone in the terrorist group prior to their radicalization. In some cases it seems clear that a social connection was the primary driver for the radicalization and involvement of an individual to a terrorist
group. In all cases, the subject will have interaction with an individual within the group in order to gain membership, but in some cases the primary driver for membership is identification with the group’s ideology, goals or structure. This criterion attempts to identify individuals who joined a group primarily because of the influence of an individual within a radical group. Although subjects who join cults often do so because of the personality and draw of the leader, this will not be counted as social recruitment. Subjects do not generally know the cult leader on a personal level and are not familiar with them prior to radicalization.

Whether individuals join radical groups for social rather than ideological reasons, it is important for identifying individuals who may be vulnerable to radicalization. If this factor is prominent in the data sets, then the United States Government could focus on identifying individuals with the appropriate skill sets who are connected to known radicals. If however, this is not a common route of radicalization, it should be clear that this method to identify vulnerable individuals cannot be depended upon. Marc Sageman has been one of the primary proponents of social radicalization theory. His study indicates that 68% of his sample either had pre-existing friendships within the jihad group that they joined, or, that new recruits often signed-up with a group of friends. An additional 20% had close family ties within the group they joined. This is an extremely strong trend in the general Islamic militant population.159
Socioeconomic Background

While recent empirical work in radicalization has shown that there is no direct link between poverty and terrorism, it does suggest that relative deprivation in the presence of other radicalization factors can create a cognitive opening for radicalization. Mentions of poverty or financial hardship in the subject’s background will be characterized as ‘deprivation’. Due to the case selection criteria of this study and the fact that the majority of the subjects are highly educated, there was not a high likelihood that there would be a strong correlation between the subjects and abject poverty. This factor also takes relative deprivation into account. Mention of the subject having less, or living in meaner circumstances than those around them, or not having a job will be coded as ‘deprivation’. If no mention of either of these situations is found and other factors point to the subject living a financially comfortable life, they will be counted as having ‘no indication of deprivation’. Given that terrorists fall into two broad categories, leaders and foot soldiers, the former are generally strongly ideologically committed, of a higher social class and better educated than the foot soldiers that may fall prey to the pressures of low socioeconomic status. While scientists are not always the leaders of organizations, a large majority possess many of the identifying factors of that group.

Education Level

Education level is an important factor in this analysis because of the studies’ heavy focus on expertise. This factor identifies how much academic training each individual has had in the life sciences. Individuals are considered at an appropriate level only if
they have completed that degree. For the purposes of this study, nursing certifications are counted as equivalent to bachelor’s degrees based on the familiarity with laboratory procedures that nurses obtain through their training. Veterinarians, PhD’s and MD’s are all counted as equal for the purposes of this study. While the PhD’s may have more laboratory experience during their education, the veterinarians and medical doctors generally have more hands on experience with and access to infectious pathogens.

The cases in this section will be examined to determine if the level of education had any bearing on whether or not the attack was successful. Technical experts assert that the level of training is vital to the success of a complex attack like one involving biological weapons. It would also make sense that a more educated individual would be able to complete complex conventional attacks with higher levels of success. The second data set was chosen on the basis of their degree qualifications and so they are necessarily more uniform when assessed for this criterion. To a certain degree, all the cases were identified on the basis of some scientific knowledge. 63% percent of the terrorists in Marc Sageman’s data set had some form of university education. This is particularly impressive given that the majority of them were from developing nations where only 5-6% of the population attends university.160

*Country of Residence*

Country of residence describes the country that the individual was living in when the attack in question was perpetrated; rather than their country of origin. In cases where
the terrorist in question had a long history of violence, the country of residence is where they committed their most notable acts. For the bioterrorists, this is the country they resided in while they participated in biological programs. For the conventional terrorists, this may be the country where they lived when they committed their most heinous acts or spent the majority of their career. The location where an individual spent their formative childhood years and the environment in which they were radicalized are also important locations. Although this interpretation includes some subjective judgment, for the majority of the subjects in this paper their country of residence was the same for their childhood, radicalization and period of violence. Any individuals who deviate from this pattern are noted in order to capture these nuances.

This factor is significant because it speaks to the relative conditions to which the person would have been exposed, including cultural, economic and political influences. In many cases we can generalize the different strains and privileges that individuals have in their lives based on the society of which they are a part. Many politicians have named poverty as one of the root causes of terrorism, if this were the case, we would expect to see the majority of terrorists living in developing countries and in destitute conditions. Political repression and discrimination is another commonly discussed radicalization factor that would lead one to expect that terrorists reside largely in repressive autocratic states. There is a theory put forward by those associated with suicide terrorism, and by academics of violence in general, that those who have suffered a violent tragedy first hand are more susceptible to committing violence themselves. If this trend applies to terrorists in general and
highly educated scientists, we would expect individuals from our sample to
disproportionately come from war torn countries or areas with high levels of violence.

With the exception of Japanese Universities, schools in the west would provide a
higher level of education and training for scientists than the rest of the countries in our
sample. Individuals living in the west with roots in another country may feel
disconnected from those around them and be more vulnerable to radicalization; this
factor is examined further in the next section. Ungoverned spaces are also a factor that
affects where terrorists will be located; countries where terrorists have the room and
freedom to organize may allow groups to be more cohesive and effective. This paper
examines socioeconomic level, political repression, education, and disaffection as
their own factors later on in the section, but it is expected that these all contribute to
whether individuals living in certain countries are radicalized to violence.

Historically there is no consensus that suggests in which country terrorists are most
likely to reside. When terrorism began to rise as a method of political expression in the
1970’s and 1980’s, it was predominately characterized by ethno-nationalist groups.
The most common locations for these groups were repressive autocratic governments
which were not totally effective, leaving room for dissent and the organization of
resistance groups. Starting in the late 1990’s, Al Qaeda has ushered in a new way of
viewing terrorist activity. Terrorism is no longer linked to a small local community; it
has become a global phenomenon and obscured the national lines for identifying
where the terrorist community resides. While the bioterrorist dataset is close to a

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universal sample given the small number of people who have committed biological terror attacks, the conventional terrorists were selected largely based on the information available about them in English language literature and media. This may have affected sample selection towards those who attacked western countries and would have been more widely reported in western media.

*Country of Ethnicity*

The country of ethnicity indicates the country of the individual’s heritage; this is generally based on where they or their parents were born. The country of ethnicity is compared against other places that the individual lived or a “change of residence” for a significant period of time. Some selection bias may be evident here, since terrorists for this section were chosen based on data available in English, so individuals who were located in the west may be overrepresented.

The comparison of country of ethnicity to any change in residence is based on radicalization theories that have sprung up in terrorist attacks on western countries. The theory asserts that one of the factors affecting terrorists who are immigrants to western countries is their disassociation from both societies. Because of racial discrimination, and the pull of their family’s culture away from western values, they do not feel fully invested in the western nation which has become their home. However, due to the fact that these individuals have never spent any significant period of time in their country of ethnicity, they do not feel fully invested in that society either. The pull of global terrorism for individuals who fit this description is that it
gives them a place where they fit in and a higher purpose. This section examines whether a significant portion of the individuals in the dataset fit this theory. Whether or not the individual’s country of ethnicity suffers from significant levels of violence or oppression, which would presumably contribute to their frustration, is examined in another section.

This theory of cultural disassociation is being applied to the majority of the Islamic “homegrown” terrorists that have struck in Europe in the past two decades. It seems to have good explanatory power for terrorists striking at targets particularly in the U.K. in the recent past. Many of the young men that are caught perpetrating or planning attacks are second generation immigrants from South Asia who are cut off from mainstream British society based on their ethnicity and yet do not truly belong to their countries of origin, and in many cases have never been out of Europe. This phenomenon has been seen in a smaller number of cases in the United States. Scholars still disagree about whether the smaller number of U.S. cases is based on the higher level of integration in U.S. society and the better living standards for the Muslim community, or whether there will be an increase in cases of homegrown terrorism in the coming years as the second generation of Muslim immigrants to the U.S. comes of age. This factor may be a significant root cause for individuals with a strong heritage which is distinct from the western society in which they currently live and contribute to a cognitive opening which makes terrorism more attractive. However, a large percentage of the population of Western countries has disparate ethnicities and do not resort to violence because they feel disassociated.
Studied in the West

Studying a scientific discipline in a western university has two main points of significance. Many individuals who come to study in the west become disillusioned with life here and commit or recommit to fundamental Islam as a more pure and moral way of life. Education in the west is also widely accepted as a better form of scientific education, and those that study here would have been the top candidates in their home countries, and would be better qualified after graduation to perform any scientific operations, including biological terrorism.

Within the general population of terrorists, very few would be as well educated as the individuals in the datasets we are examining. There does not seem to be any research attempting to quantify the amount of terrorists who study at western universities as opposed to universities in other countries. Out of the general population, an extremely small percentage of people who study at universities worldwide are able to leave their home country and study at a university in the West, this sample has a higher percentage of individuals than the general population that are able to travel to the west to study.
**Personal Trauma**

Personal trauma is considered to be a violent tragedy experienced by the subject firsthand. A close relative or friend dying from violence or being attacked either while the subject was present, or at least in their lifetime would qualify. This factor was identified predominately from literature about suicide terrorism, where research has shown that suicide bombers have a much higher likelihood than the general population to have a violent tragedy in their past.

**Gender**

The gender of the subjects in question is examined in order to test the prevailing assumption and trend that terrorists and violent individuals in general are men. Particular types of terrorist groups in the past have seemed to offer opportunities for women, and the Islamic extremist movement has begun to do so in recent years in an attempt to bypass security checkpoints. The examination of this factor will attempt to discern any unique trends in gender role for technical positions within terrorist organizations.

**Marital Status**

The marital status of the cases will give further evidence of how these individuals are similar or different from the general population. This factor, along with the individual’s involvement in institutions will help to determine whether a subject’s social capabilities have any bearing on their radicalization. While the profile of some terrorists is that they are young men with no family, little education and nothing to
lose; this description seems to fit a very distinct group of foot soldiers. Terrorist leaders are generally older, better educated, more confident and socially adept. Scientists as a whole do not fit easily into either of these categories. Trends emerging from this papers’ analysis may contribute to understanding the social standing of scientist terrorists more completely.

**Results**

This section compiles the data presented in the case study biographies and analyzes it by radicalization factor. The factors that have the most explanatory power are examined first, and several that were determined to have little relevance are summarized at the end. The list of subjects is in the same order in every chart. The list of subjects that were involved in bioterrorist events are in the first group, and are in blue. The conventional terrorists with life scientist skills are in the second group, and are in green.

*Involvement in Institutions*

Terrorist involvement in community and family institutions was determined to be the most important radicalization factor in this study. All of the subjects in bioterror data set except Rauf Ahmed pulled away from family and community institutions to be involved solely with their respective terrorist group. Conversely, all of the subjects who committed conventional terrorist attacks were still connected with society and their families. This factor is the clearest indicator in this analysis of the distinction between individuals who had the skills to commit a biological attack but chose a conventional route and those who were willing to carry out an unconventional attack.
The individuals within Aum Shinrikyo moved to live in the Aum compound. Masami Tsuchiya’s parents saw that he was pulling away from society and unsuccessfully tried to prevent it. Aum’s weapons research and production facilities required them to have their own buildings and facilities. Seclusion from society was necessary for Aum’s operational security; the fact that the group’s goal had always been the destruction of society by unconventional means indicates that Aum’s seclusion may have been intentional to allow them success in carrying out their plans. There are also indications that the insular nature of the group promoted extreme and fringe viewpoints due to the lack of a moderating voice.

Stephen Pera seems to have been a case of a genuine anti-social personality. There are multiple instances in his history that show he did not relate well to others and intentionally withdrew from interactive situations. Anand Puja was secluded from the other citizens of Oregon because of the secretive and isolated nature of the compound. Even though outsiders were allowed to visit the remote premises, they were closely monitored and only permitted to visit sections of the ranch. Puja was further isolated within the Rajneeshee cult, where she was considered vicious and cruel, and others on the compound feared the experiments that Puja conducted in her laboratory.

The higher level members of Al Qaeda, Zawahiri and Abu Khabab, were isolated from their home communities because they needed a base of friendly territory from which to run their operation. The only country that would welcome them (at the time when
their biological program was conceived) was Afghanistan, which physically separated them from their community and extended families in Egypt. Communication was made difficult because they were hunted by international law enforcement and operational security required that they not keep up robust contacts from their old life. The men further secluded themselves by not even living among the Afghan community, but in separate camps for terrorist groups.

Yazid Sufaat continued to live in his native Malaysia outside of trips to Pakistan and Afghanistan as a part of his duties for JI. After 1993, he withdrew from his position in the military and started a laboratory which would serve as a front for purchasing materials for JI/AQ and for concealing attempts to produce biological weapons. All indications are that after 1993, aside from his wife, Sufaat’s interactions were primarily with Islamic extremists.

Rauf Ahmed is the one outlier of this group, there is a lack of detail about Rauf’s personal life around the time that he agreed to help Al Qaeda, but through the details that are available, it is possible to surmise that he was connected with the local and international community. Rauf continues to be employed as a microbiologist; he had communications with other scientists during the time in question and attended an international conference on microbiology located in the U.K. Interestingly, Rauf was not a trusted member of Al Qaeda, but was brought in for his access and expertise; and soon fell out of favor because of his lack of dedication to the group. If his involvement
in normal life and the community was construed as a lack of loyalty, this may have contributed to Rauf’s dismissal from the bioweapons program.

Individuals who committed conventional attacks paint a very different picture. While there are terrorists who employ conventional means that are secluded from society, this particular group remains connected. Sabir had a steady job at the hospital and was involved in his local mosque. Rana was similarly involved, he owned local businesses, did charity work and was known in his community. Tamimi was a preacher and while his preaching was of a radical nature, he still travelled internationally to interact with others that were not within his group to convert them to his cause. He also continued to work with colleagues from George Mason University on computational biology research. Bilal Abdulla continued to stay in contact with his family in Iraq and was living with his extended family in the U.K.

Bosch, Habash, Shaqaqi and Rantisi were all ethno-nationalist resistance leaders, and as such, their base of power and support came from these communities. Keeping in close contact with them was the way these men we able to continue running their operations. The South Florida Cuban community for Bosch and the Palestinian community for Habash, Shaqaqi, and Rantisi provided access to funding, weapons and recruits. Most importantly, the goals of an ethno-nationalist group are different from the religious and ideologically motivated groups described above. Their goals are to achieve a specific political end for their people; if groups like this become cut off and isolated from their communities, they then lose their reason to continue fighting.
Aafia Siddiqui is the one subject in this group whose involvement in institutions is ambiguous. When we have details about her life in the United States it seems that she was very active in her community, helping others and reaching out to them because of her religious beliefs. At least one data point indicates that she was active in radical organizations at this time. However, from 2003-2008 we do not have the detail to understand whether she was active in community institutions or not. If she wasn’t, it may not have been of her own volition (she may have been imprisoned). Due to the fact that the clearest and most detailed information available states that Aafia was strongly involved in her community she will be counted as such in this study.

Although each case is unique and contains its own nuance, it is clear that a definitive trend has emerged. Individuals and groups who pursue biological weapons isolate themselves from society while other groups and individuals do not necessarily feel the need to do so. This statement is even more powerful because of the fact that the first data set is a universal sample of groups that have attempted biological terrorism. Some individuals in those groups were excluded due to lack of data; but every plot of biological terrorism which meets the criteria of the study (in terms of expertise) is included in this analysis, and all isolated their group and their scientists from society.
Subjects in this study seem to be slightly older than the average terrorist when they become radicalized and significantly older than the average terrorist when they are radicalized to violence. Many individuals, although they were exposed to radical ideas in school, waited until they graduated to more actively participate in a terrorist group. This factor may create a buffer of time for individuals in graduate school before they embrace radical ideals. Six out of nine individuals in the bioterror data set were radicalized during the time period they were leaving graduate school, and the

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<th>Name</th>
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<th>Involvement in Institutions</th>
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<td>Rantisi</td>
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radicalization age for Rauf Ahmed is not known. Five out of nine individuals in the conventional data set were radicalized in the time period when they were finishing graduate school. This appears to be a vulnerable age and time in the subjects’ lives and should be an area of focus for non-proliferation groups.

The average age of radicalization in the bioterrorist dataset is 24.25 years old. The three Aum scientists Yazid Sufaat and Abu Khabab appear to have been radicalized as they left graduate school. Puja radicalized later in life because that was the point at which she came into contact with the Rajneeshee cult. Stephen Pera and Zawahiri both radicalized very young, in their teenage years, and bring down the average for the group. The average age of radicalization of the conventional group is slightly older at 28.71.

The average age for radicalization to violence in the bioterror data set is 30 years old. With the exception of Pera, the group of scientists who attempted to produce biological weapons was a very mature group in comparison to the general terrorist population. Interestingly, the average age of radicalization to violence for the group of conventional terrorists was even higher, at 38.11 years. This shows that the subjects are not necessarily older because they are not technically prepared for the task of bioterrorism at a younger age; the conventional group did not make use of their technical skills, and still had an older average age. Not only was the second data set older at both points in time than the bioterrorists, but had a longer average incubation time between radicalizing and being prepared to use violence. This may be partially
due to the inclusion of so many cult members in the first data set and the isolation of the cult (from the point when individuals first join) may contribute to the shortening of the incubation period.

The most interesting distinction for this factor is the divergence between cult members and the Islamic extremists/ethno-nationalists. The difference between the average age of radicalization (26.8) and the average age of radicalization to violence (27.2) for cult members was less than half a year. The available information for the cult members indicate that as soon as they were into the group they were moved towards working on relevant weapons programs. The average difference between the two points in time for the rest of the sample, including Islamic extremists and ethno-nationalists was over ten years; showing a longer incubation period as people move into political resistance for a period of time before acting violently.
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<td>Rantisi</td>
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**Discrimination**

Discrimination, which appears as a prominent theme in the literature as a contributor to the frustrations of individuals and communities, causing them to rebel, does not feature at all in our first data set and affects just over half of the second. The distinction between bioterrorism and conventional data sets confirm that bioterrorists are less likely to be groups concerned with ethno-nationalist issues. Three of the five individuals who experienced discrimination are a part of an ethno-nationalist movement with the goal of rectifying those injustices. Although discrimination was
more prominent in the second data set than the first, it does not seem to be a primary driver for either of the groups of scientists to radicalization.

In the first data set there is no indication that any of the individuals experienced religious or ethnic discrimination from the government or society. Members of Aum Shinrikyo were accepted in society, though they did not mix with society at a high level, up until they began attacks. And the Aum members under consideration were of the same religious and ethnic make-up as the community around them. There is no evidence to suggest that the Japanese individuals were subject to religious or ethnic discrimination. Stephen Pera, Yazid Sufaat, Zawahiri, Ahmed and Abu Khabab spent their formative years in their home countries where they were in the religious and ethnic majority; there was no indication that any of them underwent discrimination in these categories. Anand Puja grew up in California, a very culturally and socially diverse place, and likewise there is no indication that she suffered from discrimination.

Drs. Habash, Shaqaqi and Rantisi were all subject to severe forms of ethnic and religious discrimination by the Israeli government. All describe the fact that their families were driven from their homes as seminal points in their lives, and witnessed injustices perpetrated on them and their families because of their heritage. A childhood Jewish friend of Ali Tamimi has described an incident where Muslims were ridiculed and degraded while Ali was present as a young teenager. Ali referred later to this incident with extremely angry language expressing his frustration. It is unclear
how much significance this one incident had, but Ali did experience religious discrimination. The only evidence for discrimination against Aafia Siddiqui is the statement she made when leaving the United States after 9/11, that “it had become too difficult to live here as a Muslim”, an indication that she and her husband were undergoing some form of persecution for their faith. There is no indication in the backgrounds of any of the other subjects that suggests they underwent religious or ethnic discrimination.

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Political and Humanitarian Motivations

This factor should be examined in conjunction with the previous factor ‘Discrimination’. Based on the fact that none of the bioterrorist subjects were motivated by strong religious or ethnic revisionist goals, they were driven by more strict political objectives. The second data set also relates to the previous radicalization factor. Individuals who experienced discrimination themselves are more likely to be motivated by humanitarian concerns, and some additional subjects were motivated to humanitarian concerns by perceiving their countrymen as victims of an attack.

All of the bioterror cases are considered to have primarily political motivations. Aum sought the fall of the Japanese government in their pursuit of a new world order. Their attacks were not in defense of a land or a people in an attempt to prevent further bloodshed. The cult that Stephen Pera was involved in had a disturbingly similar vision, that they would destroy all the humans in the world in order to protect the planet’s environment. Anand Puja and her cult were trying to win an election in their town, and showed no sympathy or remorse towards the individuals they sickened, either in the planning process, or after the attack. The individuals involved in Al Qaeda are interested in scoring a blow against the United States in their pursuit of a global Caliphate. While the protection of Muslims under this new world order may be a benefit of what they seek to achieve it does not seem to be a primary driver.
Many more of the conventional terrorists expressed to friends, family, and in public statements that the humanitarian plight of victims, generally from their same religion or country of origin, was a primary driver of their ideological shift and the reason that they were committing their actions. Siddqui expressed frustration to friends about the plight of Muslims worldwide and why other Muslims did not do a better job of taking care of them. Sabir, Habash, Shaqaqi and Rantisi all cared for those they felt were victims of oppression in their capacity as doctors. Several of the Palestinian doctors got their start practicing medicine in refugee camps and on resistance fighters. Sabir offered to perform medicine on jihadist fighters in Saudi Arabia before he was arrested. Abulla seems to have genuine humanitarian motivations. While he was upset with the political actions of Allied troops entering his country, his interest merely seems to have been their withdrawal to stop the suffering of his people rather than a regime change in the West. This information is projected from information collected about the individuals in the open source and may not be fully reflective of their motivations.
Social Recruitment

While social recruitment is a very popular theory in radicalization, it does not seem to have very broad explanatory power in the cases of the scientists examined here. Two of the scientists in each data set show that the primary driver for the individual joining the radical group was a personal connection. This is not a significant portion of either group and according to some data on terrorist recruitment in general, may be less than the average, although that is difficult to ascertain. It seems that scientists in both groups are more likely to join groups due to ideological, or other factors, rather than the pull from social ties.
Stephen Pera is assessed to have been recruited socially because although he was an isolated and disgruntled youth before he met Alan Schwandner, he did not seem to have violent tendencies or inclinations towards biological weapons. His friendship with Schwandner seems to have been the primary driver for his radicalization and for joining the group that Schwandner led. The case for Rauf Ahmed being socially recruited is less solid. Rauf was reportedly approached by a friend who knew of his extremist sympathies and expertise in microbiology; the friend put him in touch with Zawahiri, who communicated directly with Rauf from that point forward. So while Rauf had pre-existing sympathies for Islamic militants, without his social connection to the group he would never have become involved. Rauf did not seek out the group and attempt to join.

Rafiq Sabir and Tahawwur Rana were in similar social situations. Both were drawn into terrorist activity by a friend who was the more extreme and violent leader of their band. Tarik Shah, a longtime friend of Sabir, apparently led the attempts to get the two to Afghanistan; and in contact with an Al Qaeda recruiter. Similarly, the acts of terrorism that Rana is charged with were masterminded and lead by his friend David Headley. None of the other histories showed significant evidence of social recruitment. Most of the subjects in this study seem to have joined based on their interest in the group’s ideology and cause.
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<th>No, this does not seem like the primary driver</th>
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<tr>
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</table>

*Socioeconomic Background*

As expected in such a privileged sample of individuals, there is a low level of objective or relative deprivation. Individuals that were not from privileged or at the least middle class background would have a difficult time acquiring the necessary training to be counted in these data sets. Overall this factor has a lack of explanatory power and does not seem to affect highly trained scientists to a significant degree.

Ayman Zawahiri is one exception. While his family was prosperous and his father held a good job as a university professor, they lived in the extravagant expat
neighborhood of Maadi in Cairo. So in relation to their neighbors the Zawahiri family lived a modest life. Shaqaqi and Rantisi both grew up in Palestinian refugee camps and were admitted with scholarships into Egyptian medical schools based on their top high school scores as part of an Egyptian charity program for Gaza students.

<table>
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<td>Shaqaqi</td>
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<tr>
<td>Rantisi</td>
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</table>

Country of Residence

The countries in which the individuals in this study resided cover a wide spectrum, from the world’s most free and orderly nations to states on the brink of failure. Residency trends more towards the west than one would originally expect. While the
trends in this section are not strong enough to assist in focusing non-proliferation groups on any country or region, it may be helpful to note the prevalence of western residents in the data. Threat Reduction funds are currently focused on developing nations.

The bioterrorists dataset has three individuals residing in Japan, two in the U.S., one in Pakistan and three in Afghanistan at the time that they were trying to develop biological weapons. This presents an interesting dichotomy that may be instructive in determining what types of nations harbor terrorist unconventional weapons efforts. This data shows five individuals residing in liberal democracies. Strong liberal democracies offer their citizens large amounts of freedom to operate within their borders. This leeway for citizens is mirrored in states where the government is struggling to maintain its basic functions; like describes the current situation in Afghanistan and Pakistan. Countries under authoritarian rule can often be much more difficult to operate in for any type of non-state actors.

Individuals in the second dataset are slightly more uniform. Five resided in the United States, one in the United Kingdom and three in Palestine. This data may be slightly influenced by the manner of case selection, from the English language media. However, it may also be representative of the higher educated echelons of the terrorist community. Recruits from Europe and the United States may be better educated than those from rural communities of Pakistan and Afghanistan. When examining the Islamic extremists, it is interesting to note that all those involved in biological
activities resided in Pakistan or Afghanistan while all the conventional Islamic extremists were living in the U.S. or the U.K.

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<tr>
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<th>U.K.</th>
<th>Pakistan</th>
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<tr>
<td>Siddiqui</td>
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Country of Ethnicity

Detailing the country of ethnicity and whether or not the individual is still located in their country of ethnicity is useful in examining the stresses that affect the subjects in the study. Individuals in the bioterrorist data set were more likely to stay in the country of their ethnicity or to relocate to a third country than to relocate to the west. The majority of individuals in the conventional data set were individuals with ethnic backgrounds in developing countries who lived in the west. It seems clear that ethnic
tensions, particularly linked to the individual’s homeland are not significant drivers in these data sets. Issues linking a conflict to a specific local population discourage the use of biological weapons in the historical cases that are examined.

Four out of nine of the bioterrorists belonged ethnically to a developed nation and perpetrated their attack in that same country. Stephen Pera and the Japanese scientists from Aum did not experience any ethnic or national stresses that come from being in a minority ethnic group or by being torn between the culture of their heritage and the one in which the subject resided.

Anand Puja was ethnically Filipino and grew up in the United States, but she is not part of a conflict Diaspora and there does not seem to be any reason she would feel conflicted between Southeast Asia and California. The individuals from Al Qaeda either stayed in their own country or moved to Afghanistan. It seems unlikely that the Arabs would have suffered from discrimination from the Arabs, and more likely that they would have been derogatory to the Afghans.

The conventional terrorists were more likely to live in the west but have an ethnic heritage from a developing nation. Palestinian doctors all stayed to fight in their region, as would be expected of ethno-nationalists. While Bosch, also an ethno-nationalist, relocated to the United States, he was still operating in his region and was quite successful accessing Cuban targets from his base in Florida. The individuals who were located in western countries but had an ethnic heritage from another country
did seem to be affected by the dichotomy of the societies they were living in. There do not seem to be any seminal events to focus on, that were radicalizing, while the individuals were living in the west. Abdulla was particularly upset about the U.K. invasion into Iraq, but he experienced that event while he was in Iraq. Whereas, the country of ethnicity seems to be a general stressor, it does not appear to be a primary driver for most of the subjects studied; and does not present a strong enough trend to be considered a high priority radicalization factor for scientists.

<table>
<thead>
<tr>
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<th>Country of Ethnicity</th>
<th>Different Country of residence</th>
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</table>
Studied in the West

Overall it appears that while studying in the west may be frustrating and disillusioning for some, it is not a prevalent trend for life scientists who are open to radicalization. While the only successful biological attack in our sample was educated in the west, this is not a large enough sample to recognize that as a trend, and thereby project that scientists educated in the west would be more successful at biological attacks than non-western educated scientists. Ultimately, this factor did not have a particularly strong explanatory power for the radicalization of biologists.

Three of the nine individuals who perpetrated biological terrorism attacks studied in the west, and only Sufaat at the university level. Sufaat was also the only one of the three who travelled to the U.S. for schooling and then returned home. In addition, it does not appear that Sufaat radicalized while he was in the U.S. or that his time in the U.S. played a large role in his radicalization, although the sum of all his experiences left him open to radicalizing. He became more religious and appears to have turned to radical Islam after he returned home and due to family pressure.

Four of the nine individuals in the second dataset studied at western universities. Abdulla and Tamimi travelled back and forth between the Islamic world and the west, but did not travel to the west solely to study. Both of these individuals spent significant portions of their childhood in the west. Siddiqui and Sabir both resided in
the west long term. The subjects in this study are fairly well distributed across western and non-western Universities.

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_Education Level_

The factor of education level shows a clear trend towards higher level degrees. This is due primarily to the selection procedures for the study subjects. The bioterrorist data set has a somewhat surprising amount of diversity in education level given the assessments from technical experts about the level of academic training required to pursue a biological weapons program. It appears that these technical assessments may need to account for other factors in the future given the fact that Puja, who had a
nursing degree, was the only individual in the study that actually carried out a successful biological weapons attack. However, the fact that her goals were significantly more modest than the others, may account for her success.

The second data set is predictably uniform given the methods that were used to identify specialists who would have the appropriate expertise to be included in the study. The main utility in this section is to illustrate the expertise that the subjects held, and the fact that it is heavily weighted towards advanced degrees. Sageman’s work showed that the terrorists he studied were a highly educated group, and predictably, this set of scientists had a higher percentage of university educated individuals and held more advanced degrees. In addition to the degrees conferred on the subjects, it is also worth noting that the overwhelming majority of the subjects in this study, from both data sets, were considered to be “gifted”, “genius”, or “brilliant” by those who knew them when interviewed. These were not individuals who struggled with educational tasks in order to achieve the status of their academic achievement; and the majority of these subjects held tremendous scholastic aptitude that was harnessed for nefarious purposes.
<table>
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**Personal Trauma**

A number of authors who attempt to identify commonalities among the backgrounds of suicide bombers have shown that a significant number experienced a violent personal trauma. Personal trauma was examined in relation to the subjects in this study to determine if there was a similar prevalence. There was no evidence that any of the subjects in this paper had experienced a firsthand violent trauma. The Palestinian subjects were traumatized by having to leave their homes, but the literature does not mention that any members of their close family or friends were killed by Israeli troops.
Gender

The gender of the subjects in relation to radicalization is occasionally mentioned in the literature. The fact that terrorists are generally male, can lead counter-terrorism operations to focus on males. The large numbers of women in the life sciences should caution non-proliferation professionals not to discount women in their efforts. There were two women included as subjects in this study, but no trends were evident about radicalization based on their gender aside from the fact that both groups are present in the sample.

Marital Status

The marital status of the subjects was examined for any trends applicable to radicalization. Four individuals from the first data set were unmarried, and one individual from the second data set was unmarried. While this may suggest a trend and could be examined further, marriage seems to be too dependent on the culture, religious and family factors to be a valuable independent variable for radicalization.

Discussion

Utilizing the analysis of a number of radicalization factors, and their impact on two groups of biological scientists, the implications to the non-proliferation and threat reduction communities will now be examined. The analysis revealed there were factors significant to the scientists’ radicalization process and instances where they deviated significantly from the general terrorist population. Certain factors seemed to have less impact and did not present any noticeable trends between the two sets of data or between the scientists examined and the
general terrorist population. It is believed that recommendations based on data from the history of terrorism will assist in the prevention of biological weapons attacks in the future.

Involvement in institutions plays a large role in the types of attacks, and the moral limits of individuals and terrorist groups planning biological weapons attacks. Further study is needed to determine whether isolation is a driver, or a product of unconventional weapons ambitions. Follow up research on this topic would be beneficial to the non-proliferation community; and additional information gathered in this realm may allow one to discern whether individuals could be pulled back from radical unconventional weapons behavior by reintegration into communities. It would also be of value to determine if government programs would be effective by focusing on young scientists who are not yet fully radicalized.

In the meantime, non-proliferation groups should continue efforts to integrate scientists into scientific and other community institutions to help moderate their views and assure that they feel connected to the general population, which, based on this study has precluded unconventional weapons attacks. The non-proliferation community must focus their expectations for engagement along institutional lines; this indicator was valuable for trusted program leaders. But, for Rauf Ahmed, whose main job it was to obtain virulent strains of material, it was his connections to other scientists and the international community that allowed him access to advance his illegal acquisition of biological agents. Lastly, it is important to note that this data shows that involvement in institutions did not prevent or moderate the radicalization of subjects, but was a strong indicator of the type of attack that a group would attempt to perpetrate. Groups who are
planning to attempt unconventional weapons attacks are more likely to isolate their members, but not all isolated members will be a part of the unconventional weapons program.

The trends that appeared for age groups susceptible to radicalization generally follow patterns for the overall terrorist population; young men are particularly susceptible to radical ideologies. Because of the narrow parameters of this study, the results are able to be even more specific, showing a clear trend of the subjects being radicalized around the time they were leaving graduate school. While this average age of 26 matches the results of Marc Sageman’s work, it bears reiterating in the context of scientists and the significant life change they are making at this stage of life. Although non-proliferation programs currently focus on more established scientists who have a history of working with infectious diseases and select agents, it may be advantageous to focus on young scientists who have broad biological skills, and are more vulnerable to radicalization. These individuals may become radicalized and progress in their careers, but once they have the standing and expertise that make them ideal candidates for non-proliferation engagement, they may be already established as part of a terrorist organization and unlikely to be swayed by general scientist engagement protocols. Additionally, once scientists are part of a terrorist organization and inclined towards biological programs, this study indicates that those individuals will become isolated from the community and no longer reachable through cooperative engagement programs. It is important that non-proliferation efforts reach scientists in their early years, before they become violent radicals and are secluded from society.

There is not an identifiable trend relating to where the subjects study, between western and non-western universities. This indicates that non-proliferation professionals should not inordinately
focus on universities in countries or regions viewed as particularly vulnerable to terrorism. Non-state actors intent on harming the United States via biological or conventional means may be just as likely to be in western universities. This point also applies to the country of residence data, the wide variance in countries where scientifically trained terrorists reside, urges Threat Reduction programs to focus internationally without prejudice against western nations.

The fact that social recruitment was not widely used to radicalize the subjects of this study is noteworthy and should be used to encourage threat reduction programs to be certain that threats are identified in the proper manner. One of the main methods of identifying potential threats is evaluating individuals with technical backgrounds to focus on those who have a connection to terrorist groups. However, this paper’s information shows that this method of screening is not comprehensive and is not likely to identify the majority of scientists who are cognitively open to terrorist ideology and projects.

If the assumption that scientists coming out of liberal western universities are better educated and would be better able to produce a biological weapon holds true, then non-proliferation programs may go so far as to focus their efforts on western university graduates or graduates of highly ranked international universities. It does not appear that AQ intentionally recruited Yazid Sufaat for his technical expertise, but once they realized that there was a western educated biologist in their midst, AQ leadership was eager and willing to take advantage of this opportunity. Based on the differences between how Rauf and Sufaat were treated, the level of academic credentials and expertise had less to do with who was entrusted with the bioweapons program, than commitment to the group.
The country of ethnicity data did not demonstrate an overwhelming trend towards individuals with a heritage in developing countries becoming disillusioned as second or third generation immigrants. However, this trend may still be on the horizon as the U.S. Muslim immigrant community’s second generation is just beginning to come of age. If these individuals truly feel disconnected from their parent’s ethnic heritage, and the country they are living in, as theorized, this group could pose a significant threat in terms of unconventional terrorist threats. As demonstrated throughout the paper, one of the most important issues preventing subjects from committing unconventional attacks was a connection to their community. As a group of western educated and disassociated second generation immigrants are moving into their late twenties in the U.S., a new trend may soon emerge.

More research is necessary to examine the top trends that were identified and how they can be utilized to promote global biological non-proliferation aims. These trends should be used by the United States Government threat reduction communities to target their engagement of vulnerable scientists, and by the academic community to guard itself against extremism within its walls. Students should be actively engaged about dual use issues in their final semesters of graduate school to sensitize them to the horrific consequences of biological weapons. Scientists should be encouraged to engage with local and international communities and those who choose to pull away should be given special consideration as “at risk” individuals.
References

42. “Terrorist Organization Member Profile: Hideo Murai.” National Consortium for the Study of Terrorism and Responses to Terrorism, n.d.
“Terrorism and Responses to Terrorism.” National Consortium for the Study of Terrorism and the Responses to Terrorism. n.d.


Children, Graduate."

"Abd al-Aziz Rantisi." National Consortium for the Study of Terrorism and the Responses to Terrorism. n.d.

http://www.start.umd.edu/start/data_collections/tops/terrorist_organization_member.asp?id=63


"Terrorist Organization Member Profile: "Abd al-Aziz Rantisi." National Consortium for the Study of Terrorism and the Responses to Terrorism. n.d.

http://www.start.umd.edu/start/data_collections/tops/terrorist_organization_member.asp?id=63


http://www.time.com/time/world/article/0,8599,1707366,00.html


http://news.bbc.co.uk/2/hi/middle_east/7211395.stm


http://www.time.com/time/world/article/0,8599,1707366,00.html

"Terrorist Organization Member Profile: George Habash." National Consortium for the Study for Terrorism and the Responses to Terrorism. n.d.

http://www.start.umd.edu/start/data_collections/tops/terrorist_organization_member.asp?id=165


http://www.timesonline.co.uk/tol/news/uk/crime/article2039865.ece


Bibliography


GAO, “Combating Terrorism: Need for Comprehensive Threat and Risk Assessments of Chemical and Biological Attacks,” September 1999.


Moon, John Ellis van Courtland. “US Biological Warfare Planning and Preparedness: The Dilemmas of Policy.”


Speckhard, Anne. “Understanding Suicide Terrorism: Countering Human Bombs and Their Senders” in Topics in Terrorism: Toward a Transatlantic Consensus on the Nature of the Threat (Volume 11), eds. Jason S. Purcell & Joshua D.


Vogel, Kathleen. “Biowarfare Proliferation: Where Science Studies and Public Policy Collide”. Social Studies of Science, 36/5, October 2006. sss.sagepub.com


Zanders, Jean Pascal. “Assessing the Risk of Chemical and Biological Weapons Proliferation to Terrorists,” The Nonproliferation Review. 6(4), Fall 1999
