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From Discarded Leaf to Global Scourge—The Extraordinary History of the Ascent of Tobacco and its Many Modes of Consumption

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1.1

Public Health Policy and Commercial Interest—An Uneasy Equilibrium

The World Health Organization, Framework Convention of Tobacco Control (FCTC), came into effect in February 2005 [1]. The objective of the FCTC is “to protect present and future generations from the devastating health, social, environmental and economic consequences of tobacco consumption and exposure to tobacco smoke by providing a framework for tobacco control measures to be implemented ... at the national, regional and international levels in order to reduce continually and substantially the prevalence of tobacco use and exposure to tobacco smoke.” Significantly, the FCTC includes a requirement of signatories to periodically report on their progress on implementing the Treaty, thereby ensuring an active and ongoing global tobacco control effort. The FCTC, currently ratified by over 160 countries, recognizes the global nature of the tobacco industry and the growth of tobacco consumption, particularly in the developing world in the last two decades.

The worldwide consensus on the FCTC objective should portend a bleak future for entities engaged in the manufacture and sale of tobacco-related products. However, even a cursory review of the growth projections of Philip Morris and British American Tobacco suggests otherwise. In November 2009, more than 5 years after the provisions of the FCTC became binding on governments representing more than 80% of the planet’s population, an ebullient Louis Camilleri, Chairman and Chief Executive Officer of Philip Morris International (PMI), confidently predicted mid- and long-term sales volume increases of 1–2% annually and an astonishing 10–12% yearly increase in earnings per share [2]. These projections were made at a time of global economic uncertainty and when much of the world was in or slowly emerging from a deep depression. He emphasized that the free cash flow as a percentage of net revenues of PMI was 29%, second only to Pfizer

and more than twice that of “peer companies” such as Pepsi and Unilever. The market valuation of PMI is US\$100 billion as of January 2010 (equivalent to the annual GDP of the 55th largest economy in the world). British American Tobacco (BAT), the second largest tobacco company in the world after PMI, likewise reported record results in 2009, with profit growth of 15% [3]. BAT management emphasized that opportunities for enhancing sales, though limited in Western Europe, existed in Asia, Eastern Europe, and Africa.

The foregoing clearly demonstrates a fundamental conflict in public policy; there is clear recognition of the detrimental health effects of tobacco by governments and an expressed agreement to take firm measures in an attempt to limit consumption of tobacco products by their respective populations; there also exists a legal and powerful transnational tobacco industry which exert great influence on local economic wellbeing and whose products are a easy and reliable source of taxation revenue. How the products derived from the leaves of *Nicotiana tabacum* and *N. rustica*, plants used initially by indigenous peoples of the Americas as entheogens, assumed such importance is an intriguing story of economics, ingenuity, pharmacology, marketing, and duplicity.

1.2

Blessed Offspring of an Uncouth Land

Prior to 1492, knowledge of tobacco was limited to the American continent. Tobacco was smoked, chewed, drunk, inhaled as snuff, or administered as an enema by the Amerindians, who used it extensively in ceremonial, social, and medicinal situations [4]. Tobacco was ubiquitous but greatly prized, as detailed by a puzzled Columbus in his journal outlining the events of 15 October 1492, as he sailed off the shore of what is now Cuba: “we met a man in a canoe ... he had with him ... some dried leaves which are in high value among them, for a quantity of it was brought to me at San Salvador” [5]. Ironically, given the future economic importance of tobacco, Columbus discarded the offering, being obsessively focused on discovering gold, silver, and spices, the key objective of his voyage. On his second expedition, in 1493, Columbus was accompanied by Ramon Pané, a friar who was charged with describing the legends, culture, religious beliefs, and daily life of the Amerindians. Pané’s writings provide the first detailed description of the use tobacco: “he [a shaman] must also purge himself just as the sick man does, by snuffing a powder called cohoba up his nose. This produces such intoxication that they do not know what they are doing” and how a chieftain “relates the vision he had while stupefied with the cohoba that he snuffed up his nose and that went to his head” [6].

The colonization of the Americas and the introduction of Iberian agricultural practices began immediately following these first encounters [7]. The numbers of emigrants, and with them, the contact between Europe and the Americas grew rapidly, with over 85 000 people departing from Seville alone between 1506 and 1560. (Norton) Not surprisingly, knowledge of the unique effects of tobacco inges-

tion, allied to the remarkable methods used to consume the drug (smoking being heretofore unheard of outside the Americas), piqued the interest of many in Europe. Detailed descriptions of tobacco use by Amerindians were published in the many writings of the adventurers and merchants who visited the new continent in the decades following Columbus's initial voyages [8].

Initially, the export trade in tobacco was relatively limited and monopolized by Spain. Although the Spanish crown recognized the value of tobacco as a commodity that could be a stable and growing source of revenue, the main focus of Spanish activities in the Americas was the mining of precious metals (silver and gold) and the marshaling of sufficient labor to allow this activity to proceed unhindered. By 1560, tobacco seeds had been sent to Europe and plants were being grown in the Portuguese and Spanish palace gardens. The effects of tobacco, medicinal and otherwise, were subject to intense study by leading European scholars. In 1571, Nicolo Monardes, a prominent and, for the time, a widely read Spanish physician, cataloged in detail the putative benefits of tobacco in the treatment of multiple diseases, including cancer, asthma, cramps, worms, and toothache. (Norton) Monardes' theories dovetailed neatly with the classical humoral medical philosophy still somewhat prevalent in the sixteenth century [9], and helped establish the ill-founded but tenacious belief that tobacco was a therapeutic plant.

The following year, 1572, the first monograph devoted solely to tobacco was published in France. Tellingly, the author, Jacques Gohory, refers to the plant as "l'herbe de la Royne" in honor of his patroness Catherine de' Medici [10]. Gohory added to the luster of tobacco as a medicinal herb, suggesting that it was an effective remedy for chancrous ulcers, among other ailments. By the late sixteenth century, aided by familiarity, posited medicinal properties, and social cachet, tobacco cultivation and consumption, though limited, had spread throughout the known world. Portuguese traders brought Brazilian tobacco to India, Japan, Macao, China, and African ports. Spanish mariners introduced tobacco to the Philippines. In England, Raleigh and Drake had popularized pipe smoking, especially among the members of Elizabeth's royal court [11], and the popularity of smoking among the general population widened. In 1602 an anonymous author composed and published *The Metamorphosis of Tobacco* which included the lines "A worthy plant, springing from Flora's hand, the blessed offspring of an uncouth land."

1.3

A Valuable Poison

Acceptance of tobacco was far from universal, however. Tobacco was linked to heathen rituals and savage practises, issues of grave concern to those sworn to uphold Christian principles [8]. Bartolome de las Casas, a priest and the first bishop of Chiapas, who initially visited the Americas in 1502, considered smoking a vice and reprimanded his fellow Spanish colonists for their habit, urging them to cease the activity without success [12]. Girolamo Benzoni, a traveler and controversial author of *History of the New World*, published in 1565, considered tobacco

a “pestiferous and wicked poison from the devil” [13]. The introduction of tobacco into the Ottoman Empire fomented considerable debate among religious scholars and in some cases violent opposition [14]. Elizabeth’s successor, James I was a vehement opponent of tobacco, describing it as a “vile barbarous custome” and shortly after assuming the throne in 1604, he imposed a punitive duty on tobacco imports. In part, his opposition was due to the Spanish monopoly on tobacco production that required England to trade with its traditional enemy and exchange gold for a substance of no enduring value—a product that would be burned by the purchaser [15]. Furthermore, Monardes had included scrofula (ulcerous tuberculosis of the cervical lymph glands) in the pantheon of maladies that could be cured by tobacco-containing salves. Scrofula, otherwise known as the “King’s Evil,” was thought at the time to be curable only by the “royal touch,” that is by touch of the king of England or France. That tobacco should intrude into this unique prerogative of royalty was no doubt anathema to James. His autocratic royal contemporaries appear to have had similar concerns: rulers as disparate as the Ottoman Sultan Ahmed I and the last Ming Emperor of China proclaimed smoking a capital offense [16].

Despite these actions, tobacco use did not diminish. Official attitudes of detestation toward tobacco and smokers, changed to acceptance, if not encouragement, with the realization that sanctions on the import and sale of tobacco encouraged an illicit trade in the product and that tobacco import duties could be a new and potentially valuable source of revenue [17]. James I typified this trend, being forced in 1607 to reduce the duty on tobacco imports in an effort to hinder the volume of contraband trade. In 1615, he ordered the resumption of the royal monopoly over the importation of tobacco, and in 1617 sold that right for a substantial sum to a group of private individuals.

Before the establishment of Jamestown settlement in Virginia in 1607, England, unlike the France, Holland, and Spain, had not been successful in maintaining a permanent colony on the North America continent. Initially, the Jamestown enterprise almost foundered—the settlers being wracked by disease and starvation—and the London Company, which had financed the venture, teetered close to bankruptcy. Tobacco, introduced by John Rolfe, the husband of the famed Pocahontas, saved the colony from ruin. Thereafter, almost all aspects of life in the colony were subordinated to the cultivation and exportation of tobacco. Such was the importance of tobacco to the colony that for much of the seventeenth century, sterling was supplanted by pounds of tobacco as the unit of currency in Virginia (200lb = 1£ sterling) [18].

The colonists were a unique breed, willing to accept great risk in return for the promise of transport to the New World and an eventual grant of land, capitalistic by nature and circumstance, and forced into self-reliance by extraordinarily difficult living conditions [19]. These characteristics were essential for the success of the tobacco industry in North America. Most had arrived in Virginia from England as indentured laborers, initially working off the cost of their passage by toiling in the fields, performing the many manual activities required to cultivate and process tobacco efficiently. The indentured labor system operating in Virginia presaged

the introduction of slavery, which occurred in Virginia towards the end of the seventeenth century when tobacco prices fell and white labor became too scarce and expensive to employ, even on an indentured basis [20].

In 1634, the Maryland colony was established, further expanding tobacco production in British North America (BNA). In concert with the tenets of mercantilism, all tobacco leaf grown in BNA was packed in barrels and shipped on British ships to England and Scotland.

Production and export of tobacco from BNA soared during the seventeenth century, rising from 60 000 lb in 1622 to 30 000 000 lb in 1698 [21]. The increase in production in BNA was matched in mainland Europe by Dutch and German growers [21]. Inevitably, the price for the raw product, which was 96 pennies per lb in 1622 at its zenith, fell dramatically, averaging less than 2 pennies per lb between 1632 and 1770 [22]. During the late seventeenth and throughout the course of the eighteenth century, tobacco, once a luxury product, became inexpensive and available to all, and consumption of tobacco increased worldwide.

Britain and Holland became major centers for the manufacture of tobacco products, exporting to countries as diverse as France, Russia, and even Spain, and tobacco cultivation flourished throughout the Ottoman Empire, the expanding colonies of European powers and in Asia [22].

1.4 Sniffing, Chewing, and Smoking

Difficult as it is to believe today, for much of the eighteenth and nineteenth centuries, in many areas of the world tobacco was not smoked but inhaled or chewed. Nasal inhalation of ground tobacco (snuff) was especially popular among elites, devotees including such luminaries as Catherine de' Medici, George III's wife Charlotte (known as Snuffy Charlotte), and Admiral Lord Nelson [23]. In Austria, Italy, and particularly in France, snuff consumption became widespread. Snuff was introduced into China by the Jesuits at a time when smoking tobacco was illegal and rapidly gained acceptance among courtiers and wealthy merchants. Both in Asia and Europe, snuff containers (boxes and bottles) were popular gifts and frequently were objects of elaborate decoration and value. Interest in snuff waned in most of Europe in the early nineteenth century with the widespread availability of cigars, which had been a product confined to Spanish and Portuguese territories. A number of factors combined to facilitate the widespread adoption of cigars in Europe, including the introduction of an official tobacco grading system and standardized guidelines for cigar manufacture in the Spanish colonies (the primary location for cigar production), the establishment of large cigar manufacturing facilities, and alterations to the taxation structure that encouraged production, particularly in Cuba. The French, Swedish and Austrian tobacco industry were all offering cigars by 1845 [24].

By 1880, sales of snuff had fallen in all European countries except Sweden, where oral moist snuff (snus) was the most popular tobacco product, a unique

regional preference that is still apparent today. Chew tobacco was consumed by the less privileged members of society. Chew was produced by spinning tobacco leaves into rolls, which were then pressed and cut into “plugs” that were placed in the mouth, allowing the nicotine to be absorbed and the flavor tasted. Excess juice was expectorated, hence the colloquial term “spit tobacco.” In the USA, chew tobacco outsold any other manufactured tobacco product throughout the nineteenth and into the early part of the twentieth century. Elsewhere in the world, chewing tobacco was never as popular as snuff or smoked tobacco products.

1.5

The Development of the Cigarette—A Perfect Nicotine Delivery System

Graphic illustrations of cigarette-like objects (*papalete*) being smoked appear in the late eighteenth century in paintings and drawings by Goya. Cigarettes were initially the preserve of the poor and indigent, being self-rolled in paper from waste tobacco, but by the mid-nineteenth century they were being sold by some European tobacco monopolies, though in very limited quantities. Sales statistics from 1868 for the French state tobacco monopoly are illustrative; they indicate that cut tobacco (used in pipe smoking) and snuff were by far the most popular tobacco products and that cigarette sales accounted for only 0.02% of total sales. The Austrian and Italian tobacco monopolies only started offering cigarettes for sale in 1875 and 1884, respectively, a clear indication of the weak consumer demand in this part of Europe for this “new” tobacco product. During the Crimean War (1853–1856) and US Civil War (1861–1865), smoking tobacco in the form of self-rolled cigarettes was relatively commonplace among soldiers, fueling a small but growing demand for cigarettes in Britain and United States in the aftermath of the conflicts. Cigarettes might well have remained a marginal tobacco product were it not for the occurrence of a number of unrelated developments.

Prior to the advent of chemical fertilizers, land used for tobacco cultivation rapidly became depleted of nutrients, needing to lie fallow for many years if crop quality and yield were to be maintained. With growth in demand, tobacco cultivation spread westward in Virginia and into the neighboring lands of Ohio, Pennsylvania, Maryland, North Carolina, and Kentucky. Unlike the Tidewater district of Virginia, which was rich in nutrients and produced a dark aromatic tobacco when fire-cured, tobacco grown in drier and less fertile soils produced a lighter colored and milder tobacco which turned bright yellow when cured by heat—so-called bright tobacco. In the 1860s a new variety of bright tobacco, “white burley,” was serendipitously cultivated in northern Kentucky [25]. White burley was lower in natural sugars, held less moisture, could be harvested sooner than the varieties it replaced, was resistant to rotting and fungal infection and could be air-dried rather than fire-dried. Furthermore, white burley was milder and readily accepted the many additives that were used to enhance the flavor of chewing and pipe tobacco. During the same period, flue curing largely replaced the use of open fires or charcoal as the preferred method to dry or cure tobacco. Flue-cured tobacco was

milder and altered the chemical composition of the leaf, making the end-product mildly acidic rather than alkaline in nature.

Prior to these two developments, darker aromatic tobacco burned in pipes or as cigars produced an astringent and cough-inducing smoke, which was ill-suited for inhalation into the lung. Flue-cured bright and air-cured burley produced a mild, flavorsome smoke when burned, which was easily tolerated by the human airway and alveoli. This new form of tobacco when burned delivered a pharmacologically active dose of nicotine to the brain almost immediately, and the dosing was repeated on each inhalation. The addiction potential of tobacco use, long limited by product characteristics, was about to be fully realized.

Cigarettes, the perfect delivery system for the nicotine contained in tobacco, were at the outset difficult to produce commercially. Each cigarette had to be hand rolled and the maximum production of a cigarette worker was three cigarettes a minute. Vast numbers of employees were required to produce sufficient quantities of cigarettes to meet the growing demand. Tobacco companies were beset with labor and product-quality issues [26]. Characteristically, the mechanized solution to this commercial problem originated in the United States, specifically Virginia, where James Albert Bonsack, the son of a tobacco planter, was granted a patent in 1881 for a cigarette machine capable of producing over 200 cigarettes per minute.

In 1884, James Buchanan Duke, then a relatively small tobacco manufacturer in Durham, North Carolina, entered into an exclusive royalty reduction arrangement with Bonsack. The agreement not only mechanized his cigarette production process but provided him with a major competitive price advantage over other US producers. Duke went on to dominate the industry in the United States, and to create the first major truly transnational tobacco corporation, British American Tobacco (BAT) [26]. The breakup of the Duke tobacco empire in 1911, as a consequence of US anti-trust legislation, created many of the tobacco manufacturing entities that are still dominant today, including BAT, RJ Reynolds, and Lorillard.

1.6 A Century of Growth

Cigarette production was greatly facilitated by mechanization and with an increased supply of cheap and attractively packaged product, came increased consumption. Nevertheless, it was not until the aftermath of World War I, where millions of young men were exposed to tobacco, usually in the form of cigarettes, that a permanent shift from smokeless products toward cigarettes became firmly established. Cigarettes were, in many cases, shipped free of charge to troops as many in the military leadership considered them to be an essential to morale [27].

In the 1920s cigarettes became the tobacco product of choice and demand increased exponentially [24]. The ingenious use of emerging new media—billboard, radio, film, and the popular press—to promote the product to new

customers, particularly women, played a key role in this development. Throughout the 1930s the popularity of cigarettes and the prevalence of smoking in general continued to increase in the Western Hemisphere and the colonially administered countries elsewhere in the world, a trend reinforced by the outbreak of World War II.

The zenith of cigarette consumption in the Western Hemisphere occurred in the period between 1950 and 1970. Data from the United States and Germany are illustrative. For men in the United States, the peak prevalence of cigarette smoking occurred in the 1950s and was an astonishing 67% for men born between 1911 and 1930, while for women the peak occurred later (1960s) but still reached a remarkable 44% for the cohort of females born between 1931 and 1940 [28]. In Germany, equivalent prevalence rates for men (70%) occurred in the 1941–1950 birth cohort in the early 1970s, with the peak prevalence for females (50%) occurring in the 1951–1960 birth cohort [29]. Inevitably, the health toll associated with cigarette smoking of such a vast scale would finally become apparent.

1.7

An Epidemic of Disease

In truth, concerns about the relationship between tobacco and disease had not abated in the interval between the publication of King James' polemic in 1602 and the expression of concern by groups of physician investigators in the 1950s. In the late eighteenth century, the German physician Sömmerring noted the connection between pipe smoking and cancer of the lip, and this relationship was extended to other head and neck cancers by other nineteenth-century investigators [30]. Lung cancer, once unheard of, began to be reported in the early 1900s with increasing frequency [31]. The link between tobacco tar extract and carcinogenesis was elegantly described as early as 1928 by the Argentine Angel Roffo, a pioneer in translational research [32]. Unfortunately, as much of his work was published in German, dissemination of his findings was limited.

Roffo's choice of language was not incidental. Germany was, in the first 40 years of the twentieth century, the only country where research into the health effects of tobacco use was vibrant and adequately funded by government. This effort predated the establishment of the Nazi government in 1933, which, for its own ideological reasons, not only embraced basic research into the issue, but actively promoted public health measures to discourage tobacco use [33]. The authoritarian nature of the campaigns and the association of the effort with the Nazi regime ensured its discontinuance at the end of the war.

In the early 1950s, a series of landmark epidemiological studies clearly demonstrating the relationship between smoking and lung cancer appeared in the US and UK medical literature [30]. Initially many leading figures in the medical establishment were skeptical of the epidemiological findings, finding fault with the statistical approach and seeking proof of a cause and effect relationship. The tobacco industry mounted a fierce and effective campaign of dissemblment.

Insight into the strategy and approach of the US tobacco manufacturers is uniquely available, as a consequence of the disclosure process inherent in US civil litigation [4]. The four pillars of the response agreed to by industry executives at a meeting in 1953 were to: (i) promote the concept of a less harmful cigarette by producing “low tar” and “filter tipped” cigarettes; (ii) support the funding of research likely to cast doubt on scientific findings unfavorable to the industry; (iii) develop aggressive information campaigns against anti-smoking groups, and (iv) diversify corporate product lines to minimize the effect of a reduction in cigarette consumption [34]. These efforts were remarkably successful in postponing a decline in cigarette consumption. However, as evidence mounted of the cardiovascular, respiratory, and carcinogenic risks of tobacco exposure, a worldwide consensus evolved among the medical, and eventually the political community, of the need to limit exposure of the world’s population to all tobacco products, but particularly cigarettes.

1.8 Tobacco Manufactured Products—Multiple Routes to Addiction

The diverse nature of tobacco consumption can only be understood if one appreciates how the sensate characteristics of the raw tobacco leaf can be influenced by the process of cultivation and post-harvest handling. Two species of tobacco plants are grown commercially, *Nicotiana tabacum* and *N. rustica*, the former being the predominant species planted worldwide. *N. rustica* accounts for about 10% of world tobacco cultivation and is popular in Eastern Europe, especially in Russia (where it is termed *makhorka*, literally translated as “poor tobacco”) and in parts of the Middle East and Asia.

Plants of either species are very adaptable, capable of growing in a wide range of conditions, assuming different physical, chemical, and taste characteristics depending on the soil mineral content, ambient growing temperature, humidity, and rainfall. As a consequence, tobacco planted in different areas of the world produces unique flavors, tastes, and aromas [24].

Cultivation of tobacco is labor-intensive, involving germination of the plant from seed, transplantation of the plant into the field, and later, as the plant matures, removal of flowers (topping) and secondary leaf growth (suckering). The latter ensures the development of large, nicotine-rich leaves at time of harvest (usually 90–120 days from time of planting). Each plant can produce up to 25 square feet of usable leaf and up to 10 000 plants can be grown on an acre of suitably fertilized land under optimal weather conditions. On maturity, the leaf is handpicked (cropped) or mechanically harvested.

Light, aerated soil produces a light-colored tobacco leaf with a mild aroma, whereas heavier soils produce a darker leaf which has a strong flavor and higher nicotine content. After harvest, tobacco is cured, during which the carotenoids in the leaf are oxidized/degraded and the starches converted to sugar. The curing process offers further opportunities to change the flavor and color of the leaf to

meet the preferences of diverse markets. Curing methods include sun curing, where leaves are exposed to the sun and slowly dried, air curing where leaves are hung in an indoor ventilated structure and allowed to dry over four to eight weeks, fire curing where leaves are hung indoors above a fire or over slowly burning charcoal, and flue curing where leaves are hung indoors and dried by heat emanating from an enclosed source and thus not exposed to smoke.

In general, sun curing is used in the production of oriental tobacco using either light or dark leaf tobacco. Air curing is used in the production of cigarette tobacco (light leaf) and in the production of “black” tobacco and cigar wrappers (dark leaf). Fire curing is used in the production of pipe, chewing tobacco, and snuff. Flue curing is used in the production of cigarette and pipe tobacco.

After curing, tobacco leaf destined for cigar production undergoes fermentation, a process akin to composting, in which the nicotine content is reduced [35] as the leaf is exposed to a variety of yeasts and bacteria [36].

In the process of manufacturing tobacco products it is commonplace to mix different blends of tobacco, use tobacco subjected to different curing processes, and include additives (mint, berry, vanilla, licorices, sugar, rum, honey, etc.) to obtain a desired flavor.

The highly adaptable nature of the plant and the plethora of cultivation and processing options available to producers has led to wide regional, cultural, and socioeconomic variations in methods of tobacco consumption. While cigarettes have become the dominant face of tobacco consumption over the last century, multiple smoked and smokeless products continue to perpetuate global nicotine addiction in an evolving fashion. Indeed, as governments have used education, regulation, and taxation to make cigarettes less harmful and available, the market for alternative tobacco products has flourished.

In the time since Bonsack and Duke revolutionized cigarette production and distribution in the late nineteenth century, cigarettes themselves have transformed substantially to meet consumer demand and, increasingly, government regulation. From cellulose acetate filters to laser-perforated paper, every component of the contemporary cigarette has been physically and chemically engineered to facilitate nicotine delivery or enhance the consumption experience [37]. Capable of producing up to 20,000 uniform cigarettes per minute, or 9.6 million in an 8-h shift, modern cigarette machines are also highly flexible in their ability to deliver the numerous brands, strengths, and flavors required to meet a varied and dynamic market environment [37].

Despite the manufactured cigarette’s hegemonic position, other long-established smoked tobacco products maintain popularity within certain populations. In Europe, the use of roll-your-own (RYO) cigarettes has remained common among traditionalists, and, increasingly, younger smokers are attracted to the relatively lower price of RYO products, and their misleading image as healthy and natural [38]. In fact, aggressive rebranding and the rising price of manufactured cigarettes have led the trade magazine *Tobacco Journal International* to celebrate a “boom” in RYO consumption, with “growth rates exceeding ten percent over the last few years in many countries” [39]. The process of rolling RYO products is highly vari-

able among consumers, as each individual chooses the amount of tobacco, type, and size of paper, and whether to include a cellulose acetate filter. While this ability to individualize the smoking experience is part of what makes RYO products attractive, it also hampers efforts to measure their health impacts and regulate their consumption. However, given that the tobacco itself is often subject to less regulation of tar and nicotine levels, and because most users fail to include a filter, RYO products usually lead to smokers inhaling more tar, nicotine, and carbon monoxide than the manufactured alternative [40].

Produced by wrapping a roll of tobacco with leaf tobacco or other tobacco-based material, cigars are often unfiltered and their production is largely unregulated. Because of its alkalinity, cigar smoke is difficult to inhale into the lungs but is easily absorbed by the oral mucosa [41]. Because of both their size and composition, most cigars contain many times more nicotine than cigarettes, and are many times more carcinogenic [41]. Cigars are smoked primarily in the United States and Western Europe, where usage grew dramatically in the 1990s and 2000s after decades of declining consumption. Cigars are usually subject to less stringent regulation and lower levels of taxation than cigarettes, and have gained from a perception, perpetuated by athletes and celebrities in the media and popular culture, that equates cigar smoking with success and accomplishment [42].

Small cigars, a product initially introduced in the 1970s, are a growing segment of this market. Small cigars are marketed as a replacement for cigarettes. This strategy exploits weaknesses in tobacco control regulation, which is primarily directed at cigarette consumption, as cigars as a category usually have attracted lower levels of taxation than cigarettes and less onerous health risk disclosure requirements [43].

Although increasingly uncommon in the West, tobacco is also smoked extensively in pipes. Distinct to various regions in India, hooklis and chillums are clay pipes used mostly by males [44]. Water pipes, known as hookahs, narghiles, or shishas, are used to smoke strong, highly flavored tobacco. The tobacco is placed in the head of the water pipe and heated using coal or charcoal, then the smoke is inhaled through a tube after passing through a chamber filled with water. Hookah smoking is common throughout much of the Middle East, among women in India, and increasingly among young people in the West [41]. Despite an enduring myth that the water cleanses the smoke and removes its harmful effects, a typical hookah smoking session exposes the smoker to greater smoke and carbon monoxide levels than equivalent cigarette consumption [45].

Bidis are rolls of tobacco that are hand-wrapped in the leaves of tendu or ternalni plants and flavored according to local preference. Bidis are popular across South-East Asia and are the predominant form of tobacco smoking in India, where 800 billion are produced annually [46]. In India cheroots and chuttas, which are constructed without loose tobacco by rolling tobacco leaves into tight sticks, are popular, as are dhumtis, which are similar but include other leaves as well [47]. Containing approximately 40% cloves and 60% tobacco, along with hundreds of additives, kreteks are clove cigarettes popular in Indonesia. Kreteks have a unique flavor, but also produce the local anesthetic eugenol, which numbs the throat and

leads to more “intense” consumption [46, 47]. The Indonesian kretek industry produces over 100 million kreteks per day, and is increasingly focused on the export market [47].

Smokeless tobacco, and specifically the Swedish moist snuff product snus, has been aggressively marketed in North America as the industry attempts to thwart the effects of smoking bans, social stigma, and the growing awareness of the health effects of smoking. Sold loose or in viscose pouches, snus is composed of sun-cured and air-cured tobacco leaves, water, salt, sweeteners, flavors, pH modifiers, and humectants, which are ground and heat-treated in a process that is akin to pasteurization [48]. Because it undergoes heat treatment as opposed to fermentation, levels of carcinogenic tobacco-specific nitrosamines are reduced in snus when compared to other tobacco products, although considerable doses of nicotine are nonetheless delivered [49].

In Sweden, where use of snus has long been more prevalent than cigarettes, rates of tobacco-related diseases are among the lowest in the developed world [49]. This has led to some claims in the scientific and public health literature that snus should be promoted as a viable harm-reducing alternative for current smokers. While epidemiological effects of snus are inconclusive and deserving of more study, there is no doubt that it is highly addictive [49]. It is difficult to imagine how simply replacing cigarettes with snus would reduce overall tobacco dependence, and indeed, there is evidence that countries which have had the most success in reducing tobacco use generally, and smoking in particular, have done so without the “benefit” of snus [50].

The health risks associated with the use of other forms of smokeless tobacco are less ambiguous. All are highly addictive, and are associated with increased risks for cancer and other diseases of the nasal and oral cavity [41]. Dry snuff for nasal inhalation is still sold in Europe, America, India, and South Africa [47, 51]. Dipping tobacco, derived from the snus brought to America by Swedish immigrants in the nineteenth century, is moist snuff that is not heat treated but undergoes a fermentation process that enhances the flavor but contains high concentrations of nitrosamines that are associated with carcinogenicity [52]. American-style chew tobacco is also flavored and is still relatively unchanged from its historical form and is popular in the United States. Contributing to the enduring popularity of moist snuff and chew tobacco is their highly public use among professional baseball players, a population where there is a 30% addiction rate [41].

In India, there are a myriad of oral preparations, some marketed as sweets or toothpastes, which are popular within certain regions, genders, and socioeconomic groups [44]. Used traditionally for their properties as light stimulants, areca nuts and betel leaves are combined with tobacco to make pan masala (also called betel quid), which is popular across Asia [51]. Often formed by combining tobacco with calcium oxide (quicklime), sodium bicarbonate, or various forms of ash, regionally distinct preparations have evolved in Alaska (iq'mik), Sudan (toombak), Venezuela (chimo), Central Asia, and the Middle East (nass).

1.9

History Revisited or Lesson Learned

Today, the industry is diversifying its product mix in Europe and the Americas. Smokeless products are being promoted as alternatives to cigarettes in response to smoke-free places legislation and the increasingly adverse climate towards smoking in the Western world. In the developing world, opportunity awaits, and the production and promotion of tobacco, particularly cigarettes, continues unabated. In many ways, the history of tobacco in Europe and the North America is being repeated in Asia and Africa. It is in the “emerging market adult populations” that live in non-OECD countries that tobacco companies see their future growth [2]. The suppliers of leaf are now largely poor farmers in Africa and Asia, who have no influence or economic benefit from the further processing of their crop [53], a situation akin to the farmers of colonial Virginia under the tenets of mercantilism. In China, one government enterprise, the China National Tobacco Corporation, has control over tobacco crop cultivation and tobacco product manufacture and sale, a situation that echoes the state monopolies of the Europe in the past. In Africa, Malawi is the new Virginia, dependent on tobacco for 70% of its export revenue [54]. Here, as in the Americas long before, subsistence agriculture has been displaced by a cash crop, tobacco. This Faustian bargain is fraught not only with economic uncertainty and the constant threat of starvation, but a future legacy of disease and individual distress. Asia and Africa face a tobacco-related health catastrophe, unless the lessons of history are heeded. The FCTC is a bold and encouraging development, but faces significant challenges in effective implementation. The tobacco industry is resilient, dynamic, and remarkably innovative in response to public health initiatives. Governments in the developing world have many urgent priorities apart from tobacco control and addiction management. It is essential that the energy, enthusiasm, and focus of the global health community that brought about the FCTC remain undiminished until tobacco, in its many manifestations, is marginalized as a consumer product and revenue source for governments and corporations.

References

- 1 Conference of the Parties to the WHO FCTC (2003) WHO Framework Convention on Tobacco Control, http://www.who.int/fctc/text_download/en/index.html (accessed 9 March 2009).
- 2 Philip Morris International (2010) <http://phx.corporate-ir.net/External.File?item=UGFyZW50SUQ9MzYwMTkxfENoaWxkSUQ9MzUzMTk0fFR5cGU9MQ=&t=1> (accessed 4 May 2010).
- 3 British American Tobacco (2010) [http://www.bat.com/group/sites/uk__3mnfen\\$FILE/medMD82YQRB_6.pdf?openclement](http://www.bat.com/group/sites/uk__3mnfen$FILE/medMD82YQRB_6.pdf?openclement) (accessed 18 October 2010).
- 4 Goodman, J. (1993) *Tobacco in History*, Routledge, New York.
- 5 Medieval Sourcebook; Christopher Columbus: Extracts from Journal. (2006) <http://www.fordham.edu/halsall/source/columbus1.html> (accessed 18 October 2010).
- 6 The Relation of Fray Ramon Pane. (1996) <http://faculty.smu.edu/bakewell/BAKEWELL/texts/panerelacion.html> (accessed 18 October 2010).

- 7 Whitaker, A.P. (1929) The Spanish contribution to American agriculture. *Agric. Hist.*, 3 (1), 1–14.
- 8 Mancall, P.C. (2004) Tales tobacco told in sixteenth-century Europe. *Environ. Hist.*, 9 (4), 648–678.
- 9 Kell, K.T. (1965) Tobacco in folk cures in western society. *J. Am. Folk.*, 78 (308), 99–114.
- 10 Bowen, W.H. (1938) The earliest treatise on tobacco: Jacques Gohory's "Instruction sur l'herbe Petum". *Isis*, 28 (2), 349–363.
- 11 Ravenholt, R.T. (1990) Tobacco's global death march. *Popul. Dev. Rev.*, 16 (2), 213–240.
- 12 Manson, J.A. (1924) *Use of Tobacco in Mexico and South America*, Field Museum of Natural History, Chicago, IL.
- 13 Benzoni, G. (1857) *History of the New World*, The Hakluyt Society, London.
- 14 Grehan, J. (2006) Smoking and "early modern" sociability: the great tobacco debate in the Ottoman Middle East (seventeenth to eighteenth centuries). *Am. Hist. Rev.*, 111 (5), 1352–1377.
- 15 Best, J. (1979) Economic interests and the vindication of deviance: tobacco in seventeenth century Europe. *Sociol. Q.*, 20 (2), 171–182.
- 16 Ziser, M. (2005) Sovereign remedies: natural authority and the "counterblast to tobacco". *William Mary Q.*, 62 (4), 719–744.
- 17 Gray, S. and Wyckoff, V.J. (1940) The international tobacco trade in the seventeenth century. *South. Econ. J.*, 7 (1), 1–26.
- 18 Shammas, C. (1977) The determinants of personal wealth in seventeenth-century England and America. *J. Econ. Hist.*, 37 (3), 675–689.
- 19 Mitchell, R.D. (1983) American origins and regional institutions: the seventeenth-century Chesapeake. *Ann. Assoc. Am. Geogr.*, 73 (3), 404–420.
- 20 Galenson, D.W. (1984) The rise and fall of indentured servitude in the Americas: an economic analysis. *J. Econ. Hist.*, 44 (1), 1–26.
- 21 Price, J.M. (1961) The tobacco adventure to Russia: enterprise, politics, and diplomacy in the quest for a northern market for English colonial tobacco, 1676–1722. *Trans. Am. Philos. Soc.*, 51 (1), 1–120.
- 22 Gray, L.C. (1927) The market surplus problems of colonial tobacco. *William Mary Q.*, 7 (4), 231–245.
- 23 Sapundzhiev, N. and Werner, J.A. (2003) Nasal snuff: historical review and health related aspects. *J. Laryngol. Otol.*, 117 (9), 686–691.
- 24 Rogozinski, J. (1990) *Smokeless Tobacco in the Western World, 1550–1950*, Greenwood Press, Westport, CN and London.
- 25 Van Willigen, J. and Eastwood, S.C. (1998) *Tobacco Culture Farming Kentucky's Burley Belt*, University Press of Kentucky, Lexington, KY.
- 26 Kluger, R. (1996) *Ashes to Ashes America's Hundred-Year Cigarette War, the Public Health, and the Unabashed Triumph of Philip Morris*, 1st edn, Alfred A. Knopf, New York.
- 27 Meyer, J.A. (1992) Cigarette century. *Am. Herit.*, 43 (8), 72.
- 28 Giovino, G.A. (2002) Epidemiology of tobacco use in the United States. *Oncogene*, 21 (48), 7326–7340.
- 29 Brenner, H. (1993) A birth cohort analysis of the smoking epidemic in West Germany. *J. Epidemiol. Community Health*, 47 (1), 54–58.
- 30 Doll, R. (1998) Uncovering the effects of smoking: historical perspective. *Stat. Methods Med. Res.*, 7 (2), 87–117.
- 31 Cooley, M., Kaiser, L., Abraham, J., and Giarelli, E. (2001) The silent epidemic: tobacco and the evolution of lung cancer and its treatment. *Cancer Invest.*, 19 (7), 739.
- 32 Proctor, R.N. (2006) Angel H Roffo: the forgotten father of experimental tobacco carcinogenesis. *Bull. World Health Organ.*, 84 (6), 494–496.
- 33 Proctor, R.N. (1996) The anti-tobacco campaign of The Nazis: a little known aspect of public health in Germany, 1933–45. *BMJ*, 313 (7070), 1450–1453.
- 34 Cordry, H.V. (2001) *Tobacco A Reference Handbook*, ABC-CLIO, Santa Barbara, CA.
- 35 Frankenburg, W.G., Gottscho, A.M., Mayaud, E.W., and Tso, T.C. (1952) The chemistry of tobacco fermentation. I. Conversion of the alkaloids. A. The

- formation of 3-pyridyl methyl ketone and of 2,3'-dipyridyl. *J. Am. Chem. Soc.*, **74** (17), 4309–4314.
- 36 Di Giacomo, M., Paolino, M., Silvestro, D., *et al.* (2007) Microbial community structure and dynamics of dark fire-cured tobacco fermentation. *Appl. Environ. Microbiol.*, **73** (3), 825–837.
- 37 Wigand, J. (2006) Additives, cigarette design and tobacco product regulation. Report to the WHO Tobacco Free Initiative Tobacco Product Regulation Group. <http://www.jeffreywigand.com/WHOFinal.pdf> (accessed 9 May 2010).
- 38 Young, D., Borland, R., Hammond, D., *et al.* (2006) Prevalence and attributes of roll-your-own smokers in the International Tobacco Control (ITC) Four Country Survey. *Tob. Control*, **15** (Suppl. 3), iii76–iii82.
- 39 Boom in smokeless and RYO fuels packaging machinery. (2010) *Tob. J. Int.* http://www.tobaccojournal.com/Boom_in_smokeless_and_RYO_fuels_packaging_machinery.49935.0.html (accessed 9 May 2010).
- 40 Devlin, E., Eadie, D., and Angus, K. (2003) *Rolling Tobacco: Prepared for NHS Scotland*, The Center for Tobacco Control Research—University of Strathclyde, Glasgow, Scotland, <http://www.tobaccopapers.com/casestudies/Rolling-Tobacco.pdf> (accessed 21 May 2010).
- 41 Viegas, C.A.A. (2008) Noncigarette forms of tobacco use. *J. Bras. Pneumol.*, **34**, 1069–1073.
- 42 Wenger, L.D., Malone, R.E., George, A., and Bero, L.A. (2001) Cigar magazines: using tobacco to sell a lifestyle. *Tob. Control*, **10** (3), 279–284.
- 43 Delnevo, C.D. and Hrywna, M. (2007) A whole “nother smoke” or a cigarette in disguise: how RJ Reynolds reframed the image of little cigars. *Am. J. Public Health*, **97** (8), 1368–1375.
- 44 Reddy, S.R. and Gupta, P.C. (2004) Report on Tobacco Control in India. [http://mohfw.nic.in/tobacco%20control%20in%20india_\(10%20dec%2004\).pdf](http://mohfw.nic.in/tobacco%20control%20in%20india_(10%20dec%2004).pdf) (accessed 18 October 2010).
- 45 Eissenberg, T. and Shihadeh, A. (2009) Waterpipe tobacco and cigarette smoking: direct comparison of toxicant exposure. *Am. J. Prev. Med.*, **37** (6), 518–523.
- 46 Prignot, J.J., Sasco, A.J., Poulet, E., Gupta, P.C., and Aditama, T.Y. (2008) Alternative forms of tobacco use. *Int. J. Tuberc. Lung Dis.*, **12** (7), 718–727.
- 47 Hammond, S.K. (2009) Global patterns of nicotine and tobacco consumption, in *Nicotine Psychopharmacology* (eds J.E. Henningfield, E.D. London, and S. Pogun), Springer, Berlin and Heidelberg, pp. 3–28.
- 48 Imperial Tobacco Canada (2010) Smus. http://www.imperialtobaccocanada.com/groupca/sites/IMP_7VSH6J.nsf/vwPagesWebLive/DO7VXNY?opendocument&SKN=1 (accessed 18 October 2010).
- 49 Melikian, A.A. and Hoffmann, D. (2009) Smokeless tobacco: a gateway to smoking or a way away from smoking. *Biomarkers*, **14** (s1), 85–89.
- 50 Physician for a Smoke-Free Canada (2007) The Snus Experience. http://www.smoke-free.ca/pdf_1/snus-comparative-experiences.pdf (accessed 18 October 2010).
- 51 U.S. National Institutes of Health—National Cancer Institute (2002) Smokeless Tobacco Factsheet. http://cancercontrol.cancer.gov/TCRB/stfact_sheet_combined10-23-02.pdf (accessed 20 May 2010).
- 52 Hoffmann, D. and Djordjevic, M.V. (1997) Chemical composition and carcinogenicity of smokeless tobacco. *Adv. Dent. Res.*, **11** (3), 322–329.
- 53 Clairmonte, F.F. (1979) World tobacco: dynamics of oligopolistic annexationism. *Econ. Pol. Wkly*, **14** (30/32), 1331–1344.
- 54 Otanez, M.G., Mamudu, H.M., and Glantz, S.A. (2009) Tobacco companies' use of developing countries' economic reliance on tobacco to lobby against global tobacco control: the case of Malawi. *Am. J. Public Health*, **99** (10), 1759–1771.

