

University of Nevada, Reno

**Framing Rickets: Diet, Heredity and Environment in Great Britain and France
1860-1930**

A thesis submitted in partial fulfillment of the requirements for the degree of Master of
Arts in History

By

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prepared under our supervision by

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Abstract

This thesis will demonstrate how different medical, political and social factors framed the way physicians and researchers diagnosed, examined and treated children with rickets in Great Britain and France from 1860 to 1930. Population anxieties caused by war, a declining birth rate, and a rising infant and child mortality rate, as well as a growing concern over children's health, formed the background for research into the causation and treatment of rickets, in which diet, climate and heredity were considered to be causal factors. These factors were examined by physicians and researchers through two different research methods, clinical medicine and experimental medicine. Physicians and researchers in Great Britain successfully used both methods in the examination of rickets to identify the causation of the disease. In France, physicians and researchers primarily used the clinical approach. Furthermore, their understanding of rickets was characterized by a strong tendency to emphasize heredity. Historiographies on childhood, children's health and welfare, population anxieties, medicine, and rickets itself, support arguments made here based on primary resources (such as the importance of the clinical approach in both countries, the use of the experimental approach and the emphasis on diet and environment in Great Britain, and the prevalence of the heredity theory in France) by illustrating how the study of rickets addressed concerns about population and children's health. This study contributes to these different threads of historiography by using medical publications, including those based on lectures and clinical case studies, as well as statistical surveys to demonstrate how the disease was framed and the effect this had on the research concerning rickets.

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Introduction

This thesis is a comparative analysis of the diagnosis and treatment of rickets in children in Great Britain and France from 1860 through 1930 focusing on how researchers considered the causal factors of environment and heredity. In this comparison between British and French management of rickets, I will be uncovering the ways in which these societies treated children with this particular disease. These differing diagnoses and treatment methods reflect the ways in which these two societies attempted to prevent this disease in children. I will ask why rickets became a concern in these two countries, in the context of general anxieties over children's health. This thesis will show that although rickets was a problem in both Great Britain and France, in these countries, physicians and researchers had some different understandings of this disease. Physicians and researchers in both countries examined rickets through a multi-causal lens, believing that factors of diet, environment and heredity could be to blame.

In Great Britain, researchers came to reject the idea of heredity as a causal factor in rickets, and were focused on how environmental factors, such as diet and climate, affected the development of rickets. This was accomplished through statistical surveys, experiments, and observational studies. In France, where research methods emphasized clinical observation, the belief that rickets was hereditary was carried into the early twentieth century by most physicians and researchers. As in Great Britain, some physicians and researchers in France thought environmental causes also influenced the development of rickets. Finally, I will look at the reasons and consequences of these different etiological and research orientations in Great Britain and France.

Thus, this thesis focuses on the social, medical, and political concerns regarding rickets in children in France and Great Britain. In order to accomplish this thesis, I need to approach the topic by looking at the anxieties about population during the time, the issues about infant and childhood mortality, why rickets was a prominent disease, ideas on how to treat rickets, how these ideas were similar and different in Great Britain and France, the effects that these changes had, and the ways in which the disease has been framed by physicians and historians.

In *Framing Disease* (1992) Charles E. Rosenberg and Janet Golden argue that “disease serves as a structuring factor in social situations, as a social actor and mediator”.¹ They demonstrate that cultural understandings provide a background for diseases and affect the way they are diagnosed, treated, and viewed in society. Cultural ideas and anxieties in Great Britain and France, regarding war, health, diet, and disease helped frame the way researchers and physicians were looking at the diagnosis, causation, and therapeutics of rickets.

This analysis illuminates the ways in which a society’s beliefs about causal factors (environment and heredity) for a particular disease influences the way in which the disease itself is diagnosed and treated. Rickets in Great Britain and France, in this specific time period, demonstrates that beliefs about causal factors acted as the science behind how to diagnose and treat rickets in children. The ways in which physicians and researchers, in these two countries, framed the disease in social terms (environment and heredity) determined the likelihood of a child’s survival.

¹ Charles Rosenberg and Janet Golden, *Framing Disease: Studies in Cultural History* (New Brunswick: Rutgers University Press, 1992), xviii.

This analysis demonstrates the ways in which rickets fits into Rosenberg's model illustrating that different societies, both constructed and managed the same disease in different ways. There was not one particular agreed upon way to perceive, name, and respond to rickets, therefore there was no common or agreed upon definition for how the disease would affect these countries. These countries' differing approaches speak to the complexity of and difficulty in treating the disease. As Rosenberg points out "disease does not exist until we have agreed that it does, by perceiving, naming, and responding to it".² Medical historian Roger Cooter pointed out that Rosenberg, writing in the 1990's, was the logical next step in the evolution of medical history. Rosenberg, according to Cooter, insisted that medicine and disease were not about social control or power, as had been dominant in the field previously. Instead, medicine and disease are cultural constructs which were to be framed differently in different societies at different times.³ In this way, rickets had a different effect on different societies based on the ways those societies framed it, and thus the disease became a social actor. Factors such as diet, war, population anxieties, medicine, and children's health had different impacts on these two societies, and as a result, impacted the ways rickets would be framed both by researchers in this time period and by historians later on. In the context of the interaction between social histories of medicine and others which choose instead to "frame" it, this thesis contributes an in-depth series of case studies which demonstrate that in fact a multi-faceted, unrestricted approach to medical history is more productive than the restrictive social approach focused on power and control. This thesis demonstrates that framing

² Rosenberg and Golden, *Framing Disease*, xiii.

³ Roger Cooter, "'Framing' the End of the Social History of Medicine" in *Locating Medical History: The Stories and Their Meanings*, ed. Frank Huisman and John Harley Warner (Baltimore: The Johns Hopkins University Press, 2004), 323.

rickets in Great Britain and France at the turn of the twentieth century was as much about population anxieties caused by war, poverty, declining birth rates, and rising infant mortality rates, as it was about curing a childhood disease. In addition, this thesis showcases the emergence of clinical and experimental medicine and the ways that these different methods were used by physicians and researchers in these two different societies through their examination and treatment of rickets. Through this “frame”, this thesis will show that although the disease was viewed through a multi-causal lens in both countries, in Great Britain diet and environment became the important causal factors, while in France heredity remained a constant causal factor.

In the time period studied here, rickets became recognized as a major problem in pediatrics, but the diagnostic criteria and treatment varied greatly among physicians. From the 1860’s observational studies, experiments on animals, and statistical surveys had a profound effect on this developing understanding. As these new developments began to take place, understandings concerning the causes and the treatments for rickets began to transform as well. In the 1860’s, physicians were at odds about the causes of rickets, but by the 1930’s many had come to focus on diet and finally on Vitamin D in both Great Britain and France. By the 1930’s medical transformations in technology and science, such as the discovery of vitamins and the use of UV rays and cod liver oil, led to a more definitive understanding of rickets, its etiology and therapeutics. Physicians and researchers came to understand that some diets created deficiencies. It also became clear that rickets was increasing due to a transforming environment. A diet of Vitamin D enriched foods, or supplements such as cod liver oil, became commonplace. This thesis

will focus on the era before the discovery of Vitamin D, a time when rickets became a major concern but its cause remained unclear.

What is Rickets?

Rickets is a disease that “occurs when a person’s growing bones – and some cartilage – fail to receive sufficient quantities of calcium and other minerals. The consequent lack of proper ‘mineralization’ results in aberrant bone growth and skeletal deformity”.⁴ Rickets is primarily a disease of infants and children. When found in adults, it is referred to as Osteomalacia. Children who display characteristics of rickets due to this aberrant bone growth and deformity will often have “a hunched back, a deformed or enlarged head that the sufferer has difficulty in holding up, deformed wrist or finger bones, the growth of large knobs of bone at the ends of the ribs,” also known as ‘rachitic rosary’, “and a concave chest or, conversely, a ‘pigeon breast’”.⁵ Bad teeth, muscle spasms, gastrointestinal problems, and especially ‘knock-knees’, or the bending of the long bones of the leg are also typical manifestations. As shown by Anne Hardy, rickets “was widespread among most social classes in Victorian cities” in Great Britain, it is however difficult to get an exact estimation of the extent of rickets on children in Great Britain and France.⁶ Although the medical literature from the time shows that it was a serious concern in both countries, there are no statistics that demonstrate the extent to which this disease affected the population. However, as will be shown through the primary research of Dr. Thomas Hillier, the frequency of rickets “would not be suspected

⁴ Kenneth Kiple, *Plague, Pox, & Pestilence* (London: Weidenfeld & Nicolson, 1997), 130.

⁵ Kiple, *Plague*, 130.

⁶ Anne Hardy, "Rickets and the rest: Child-care, diet and the infectious children's diseases, 1850-1914," *Social History of Medicine* 5 (1992): 98.

from a study of statistical tables. It is a very frequent cause of death; yet so seldom is it assigned as the cause that the Registrar-General has not found it necessary to devote a column of his tables of mortality to this disease”.⁷ As Hardy argues and Hillier observed rickets was often not registered as the primary cause of death because it often rendered a secondary cause of death fatal, which was then recorded as the cause of death. Although there are no official records that indicate the severity of the disease, the secondary and primary sources concerning this disease and time period show that it was a major concern among physicians and researchers.

Rickets is caused by a Vitamin D deficiency in the body. Although rickets is the result of a failure to receive sufficient amounts of calcium and other minerals, such as phosphate, which help the bones and teeth develop and grow strong, it is most importantly a result from a lack of Vitamin D in the child’s diet and/or routine.⁸ “A deficiency of Vitamin D results in a lack of adequate amounts of calcitriol, which in turn leads to unregulated bone growth”.⁹ In the body, Vitamin D undergoes “a process called ‘hydroxylation’, which changes it into an active hormone known as calcitriol, whose function is to facilitate bone growth. It does this primarily by regulating body levels of calcium and phosphate”.¹⁰ Vitamin D can be obtained through dietary factors, such as cod liver oil and some dairy products, and it is produced when exposed to UVB rays from the sun, which when they hit the skin stimulates the production of Vitamin D by skin

⁷ Thomas Hillier, *Diseases of Children: A Clinical Treatise, Based on Lectures Delivered at the Hospital for Sick Children, London* (London: James Walton, 1868), 79.

⁸ Kiple, *Plague*, 130.

⁹ Kenneth F. Kiple, *The Cambridge World History of Human Disease* (Cambridge: Cambridge University Press), 130.

¹⁰ Kiple, *Human Disease*, 130.

cells.¹¹ Vitamin D deficiency, although easily remedied, was the primary cause of rickets in children during the 1860's through the 1930's, because this simple remedy remained undiscovered.

It is important to examine how rickets fits into the larger context of childhood diseases and the problem of overlapping or conflated diagnoses. There are major trends in the historiography on rickets that guide this thesis. These include the historiography of childhood, policies on children and children's health, medicine including observational and experimental, concerns about children's health, and the history of rickets itself. These trends allow this work to focus on environment and heredity, specifically related to diagnosis and treatment, and the ways in which these two societies addressed both.

Works such as *Rickets* (1991) by Francis H. Glorieux, *Vitamin Discoveries and Disasters: History, Science, and Controversies* (2009) by Frances Rachel Frankenburg, *Rickets and the Rest: Child-care, Diet and the Infectious Children's Diseases, 1850-1914* (1992) by Anne Hardy, *Chemical Physiology Versus Biochemistry, the Clinic Verses the Laboratory, the Glaswegian Opposition to Edward Mellanby's Theory of Rickets* by D.F. Smith and M. Nicholson and two works by Kenneth F. Kiple, *The Cambridge World History of Human Disease* (1993) and *Plague, Pox & Pestilence* (1997), cover the general history of rickets, show how advancements in medicine and technology changed etiological understandings and diagnosis, as well as therapeutics. These works look at rickets from the medical perspective, social perspective, and in the context of the

¹¹ Deborah Kotz, *Time in the Sun: How Much is Needed for Vitamin D*, <http://health.usnews.com/health-news/family-health/heart/articles/2008/06/23/time-in-the-sun-how-much-is-needed-for-vitamin-d> (June 23, 2008).

emerging ideas about vitamins. Glorieux in *Rickets*, and Kiple, in *The Cambridge World History of Disease*, focus on the disease itself. While Glorieux takes a more scientific approach by showing the structure of the disease, Kiple in both *The Cambridge World History of Disease* and *Plague, Pox & Pestilence* looks at the first known origins of the disease, and traces it through history. However, in *Plague, Pox, and Pestilence*, Kiple discusses the constructs of the disease and change in treatments, over time. Hardy examines rickets by examining the influence it had on whooping cough and measles during her selected time period. Her work focuses on why death rates for children from whooping cough fell, while death rates for children from measles rose. She demonstrates that this was due to the influence of rickets which determined the different patterns of whooping cough and measles.¹² In her examination of these diseases she gives insight into the problem rickets posed in Great Britain and how diet and concern for children's health affected the disease. In regards to rickets she examines if diet or changing childcare practices had an effect on the slowly declining number of deaths from rickets at the turn of the twentieth century. She shows that "a small reduction in the prevalence or severity in rickets could have been critical in producing the downturn in whooping cough fatality, and that this was achieved less through dietary improvement than through

¹² Hardy believes that a small reduction in rickets cases due to "improved child-care practices rather than by nutritional improvement," can be linked to a decline in the number of whooping cough cases. She believed improvements in child-care practices that included fresh air, exercise and breastfeeding led to this decline. Other changes included the abandonment of the cold bath, the distribution of pamphlets on infant and children's health, home visits, and personal instruction by The Ladies' Sanitary Association, and an emphasis by physicians through medical manuals and pamphlets that emphasized sustaining children through the childhood illnesses that occurred. She shows that these child-care practices were more important than diet because there was no decline in the number of measles cases which would have declined with nutritional improvement. However, whooping cough cases declined due to these changes in child-care practices. Hardy, *Rickets and the Rest*, 411.

changing childcare practices”.¹³ In “Chemical Physiology Versus Biochemistry,” Smith and Nicolson examine the debate about the role of vitamins in rickets. They demonstrate that while Edward Mellanby (through his experiments on puppies with rickets) had come to the conclusion that it was a vitamin deficiency that caused rickets, other researchers such as Lionel Findlay believed that other factors such as lack of exercise was to blame, and believed that vitamins played no part in the causation of rickets.¹⁴ Frankenburg examines the discovery and importance of Vitamin D, how it was linked to rickets and how it was implemented into treatment plans for patients with rickets. These works are part of the different threads of historiography that make up this thesis, and their findings are reinforced by the information contained in the primary sources used in the thesis.¹⁵

The historical record of rickets dates to around 300 B.C. During this time, up through the tenth century, Chinese, Greek, Roman, and European physicians wrote about children displaying many of the symptoms of rickets, although many of these records could easily be describing other diseases. Rickets, also known as the “English Disease” became an official medical term in 1634, when it was used in the English Bill of Mortality report. After this report, work by researchers began to focus on where the disease was most prevalent, if it pertained to a certain class of people, and what symptoms were the most dominant. The search also began for the cause and treatment for the disease. Although some progress was made in discovering that it was found more

¹³ Hardy, *Rickets and the Rest*, 397.

¹⁴ D.F. Smith and M. Nicolson, “Chemical Physiology versus Biochemistry, the Clinic versus the Laboratory, the Glaswegian Opposition to Edward Mellanby’s Theory of Rickets,” *Proceedings of the Royal College of Physicians Edinburgh* Vol. 19 (Jan 1989): 51-60.

¹⁵ More of the different threads of historiography used for this thesis will be discussed in Chapter 1.

in northern, cold climates, it was not until the late nineteenth and twentieth centuries that real progress in understanding and treating the disease took place.¹⁶

Great Britain and France were just two of many countries faced with the problem of childhood rickets in the late nineteenth and early twentieth centuries. Due to their northern climate, as well as other factors such as dietary standards and living environments, rickets was a prominent disease that affected the mortality rate of children. As shown by Anne Hardy, “it was a largely urban disease, occurring among all social classes, and in its active form, among children of weaning age”.¹⁷ Although other countries such as Germany, Northern Italy, Austria, and the Netherlands also faced this disease, Great Britain and France’s medical approaches to the disease illustrate interesting contrasts in diagnosis and treatment. In both cases medical and social concerns over rickets show similar political and social issues in regard to population anxiety, as well as family and child welfare, which led to a new discourse concerning children’s health. However, with France focused on heredity as the causal factor of rickets, and Great Britain focused on environmental factors, such as diet and climate, the therapeutics used by both countries in regards to rickets were different.

Organization of Thesis

Chapter One focuses on the population anxieties that characterized the policy making and medical communities of Great Britain and France in the late nineteenth and

¹⁶ As shown in the *Cambridge History of World Disease and Plague, Pox and Pestilence*, some of the physicians who described these characteristics of the disease included Lu-pu-wei in China in 300 B.C., Chien-i in tenth century China, Soranus of Ephesus in Second Century Greece, and Galen in Rome. Although it is believed that many of the cases they described were rickets based on their description of the symptoms present, these also could have been describing another disease mistaken for rickets.

¹⁷ Hardy, *Rickets and the Rest*, 390.

early twentieth centuries. It discusses what issues caused these anxieties as well as the different welfare policies that were put into place as a result of the concern over population, including how a rise in concern over children's health led to researchers examining rickets as well as other children's diseases. Chapter Two focuses on British medical approaches to rickets and the factors that helped frame how physicians and researchers addressed rickets. This chapter examines where rickets was most dominant, by examining issues of class and location and why these had such an effect on the predominance of rickets cases. In Great Britain, the Industrial Revolution affected the incidence of rickets as well as its explanatory model. This chapter shows how researchers in Great Britain focused primarily on experimentation on animals such as rats, puppies, and lion cubs in their quest to understand causes and treatment.

Chapter Three focuses on how French medicine addressed the issue of rickets, in comparison to Great Britain. French researchers emphasized case studies and often assumed that hereditary factors were causal. Chapter Four compares case studies from each country. This will demonstrate what diagnostic factors were emphasized in regards to their patients, the understanding of causation, and what treatment was applied. By examining these issues in relation to the population crisis that was being faced, this thesis addresses why rickets was so common for children during the late nineteenth and early twentieth centuries in Great Britain and France, and why their approaches to understanding and dealing with this disease were so different. Finally, it will examine cross cultural influence between Great Britain and France.

Chapter One

Population Anxiety and the Rearing of Healthy Children

The focus on rickets at the turn of the twentieth century was part of a rising concern over children's health in Northern Europe and North America. This concern arose in the context of a developing social and cultural conception of childhood itself. The child was not always viewed as a separate entity from the adult. Historians, in particular Philippe Ariès in his book *Centuries of Childhood*, believe that childhood did not really exist until the seventeenth century. It was during this time that a rise in education for children, and a lower infant and child mortality rate contributed to children beginning to be valued as important members of not only the family, but also as members of society.

As discussed in the introduction, this thesis draws from many different threads of historiography, including the historiography of childhood. Although this consists of a large amount of literature, there are a few pieces of that large body of historiography that show how important the transitions that took place in the way childhood was viewed, led to a rise in the interest in the health of the family and the child. Philippe Ariès in *Centuries of Childhood* showed this transition. Ariès is important to the historiography of childhood because he showed that childhood was a historical construct. He illustrated that starting in the seventeenth century and continuing into the nineteenth century, the child began to be thought of as existing in a separate sphere from adults.

Education contributed to this belief because it helped separate the child from the adult world and developed into the idea of childhood, this is shown by Colin Heywood in *Childhood in Nineteenth Century France: Work, Health, and Education among the 'classes populaires'*. In this book, Heywood takes a different approach to the history of childhood by examining the effects that work and education had on it. In order to accomplish this, he examines the history of childhood through industrial developments, reform efforts, and state legislation. Through this work, Heywood's goal is to answer three questions about childhood in the nineteenth century. These questions were; why did the employment of children become a public issue in the nineteenth century, why did a change in education take place, and how did the French state handle child welfare? By looking at these issues, Heywood's goal is to show that the change in childhood that took place in the nineteenth century would affect the way children grew up from the nineteenth century forward. This change that occurred was that children "over the course of the nineteenth century, they slowly abandoned their work in the fields and workshops, in order to move, definitively, to the school benches. Henceforth they were destined for an existence more segregated from society at large".¹⁸ Heywood's work has been an important step in the historiography of childhood due to his examination of the role of childhood labor and education.¹⁹ During the nineteenth century, researchers also began to view children in a separate sphere, further focusing on the diseases that were more common to them. Through these changing thoughts on children and childhood, the

¹⁸ Colin Heywood, *Childhood in Nineteenth-Century France: Work, health, and education among the 'classes populaires'* (Cambridge: Cambridge University Press, 1988), 3.

¹⁹ Ariès and Heywood were not the only historians addressing the topic of childhood; other important historians examined this field as well. Some historians focusing on childhood include Lloyd DeMause, and Edward Shorter who have focused their studies on the issue of childhood itself, including what childhood consisted of and the role of children in the family and society.

focus on children's health became more prominent. As shown by Michel Foucault in *Power/Knowledge*, the health of the child became the focus of the family. He stated that one of the most important aspects of the family became the survival of the child "to adulthood, the physical and economic conditions for this survival, the necessary and sufficient amount of investment for the period of child development to become useful".²⁰ Through shifting ideas on childhood, the role of children in the family and their health began to change. With this advancement of thinking concerning children, when the birth rate began to decline and the mortality rate began to increase in the nineteenth century, children became the main focus, hoping to stop the problem at the source.

Although both countries were dealing with similar concerns, they addressed these matters in different ways. The concern over infants and children's health throughout the nineteenth century became a social, political, as well as medical dilemma in both Great Britain and France, which raised questions about the health of current and future populations in each country. With both countries facing wars, as well as a decline in births, both governments began to turn their attention to how to ensure a successful future, believing that a focus on children would be the best way to do this. Historians Deborah Dwork, Alisa Klaus, and William H. Schneider, as shown below, discuss population anxieties and population discourse revealing how the wars, beliefs about eugenics, and a declining birth rate led to different concerns and theories regarding children's health in both Great Britain and France. While Dwork and Klaus demonstrate that these population anxieties led to a rising concern about children and mother's health,

²⁰ Michel Foucault, *Power/Knowledge: Selected Interviews and Other Writings 1972-1977* (New York: Pantheon Books, 1980), 172.

Schneider shows that part of the discourse on population began to be focused on how to create a better quality of population for the future, one that did not consist of degenerates and was healthy and strong. The historiographical analysis of these works shows how these approaches about population anxieties were addressed, but in different ways. These works demonstrate how important population discourse became during the late nineteenth and early twentieth centuries, and the different ways that it affected views on children's health.

War and population concerns

In the late nineteenth and early twentieth centuries both countries faced competition from Germany as a commercial power as well as a military power. For both countries, what was particularly alarming was Germany's economic growth related to its rising birth rate. Warfare had a great effect on many aspects of life in Great Britain and France. In Great Britain, the Boer Wars (1880-1881, 1899-1902) led to an amplified interest in a strong and healthy population. Examinations for military service found a discouraging number of health problems, and a large number of rejections occurring. As demonstrated by Deborah Dwork, "In 1898, the medical department of the army inspected 66,501 recruits and 23,287 were rejected".²¹ Many men were seen as physically unfit to serve. For Great Britain, which thought of itself as a leading European power, the thought of having an unhealthy population not fit to serve the needs of its

²¹ Deborah Dwork, *War is Good for Babies and Other Young Children: A History of the Infant and Child Welfare Movement in England, 1898-1918* (London: Tavistock Publications, 1987), 12.

country frightened both politicians and the public alike. The Franco-Prussian War also led to population anxieties within France.²²

In *War is Good for Babies and Other Young Children*, Dwork shows that along with a largely unfit male population, Great Britain was also experiencing a declining birth rate as well as a rising infant mortality rate. In 1874, the office of the Registrar-General, made it compulsory to report births and deaths with the Births and Deaths Registration Act, which brought attention to the declining birth rate.²³ This act “made it mandatory to report a birth within forty-two days”.²⁴ Due to this act, Great Britain was able to keep track of the births with the clear goal of ensuring that the birth rate was steady. However, between the time it was enacted and 1897, Great Britain began to see a considerable drop in the birth rate, which caused some alarm. During this time, based on those records, Dwork reports a drop of 14.1 percent, from 35.5 per 1000 to 30.5 per 1000.²⁵ Although this was alarming to the British government, they were not the only country experiencing a decline in the birthrate.

As Alisa Klaus shows in *Every Child a Lion*, France also faced a declining birth rate at this time. France was the first European country during this period “to experience a decline in the birthrate; in view of the military threat posed by Germany, many

²² The subject of population and population anxieties in Great Britain and France has produced a large number of works including *Population Growth and Economic Development since 1750* (1972) by H.J. Habakkuk, *Population and Society in Twentieth-Century France* (1978) by Colin Dyer, *France Faces Depopulation* (1979) by Joseph J. Spengler, *The Population of Britain in the Nineteenth Century* (1995) by Robert Woods, and *The Great War and the British People* (2003) by J.M. Winter are just a few of the works of literature that address the issue of population in these two countries.

²³ Dwork, *War is Good*, 3.

²⁴ Dwork, *War is Good*, 3.

²⁵ Dwork, *War is Good*, 4.

observers warned that this demographic trend was a potential national catastrophe”.²⁶ Believing that a high birthrate equaled a prosperous nation, France was concerned about its place among the European powers, especially compared to Great Britain and Germany. The decline in birth rate in France was even more dramatic than in Great Britain. Compared to Great Britain, in France the birthrate declined from 38 per one thousand people before 1789 to 18.8 by World War I.²⁷ In addition to a declining birth rate, both Great Britain and France were also experiencing an increase in epidemic diseases such as cholera, typhoid, diphtheria, and tuberculosis, which were products of urban crowding, but which also spread to rural areas.²⁸ This, and the declining birth rate, created much consternation because not only were more infants not living through childhood, these deaths were also not being replaced with new lives, causing a rise in population anxieties in the governments of Great Britain and France. Through this, France’s theory of ‘depopulation’ began to take root. Klaus points out that “beginning in the five years before the Franco-Prussian War, sociologists, demographers, journalists, researchers, and politicians described depopulation as the source of France’s military weakness, economic stagnation, and moral degeneration”.²⁹ It was these factors, which were seen throughout all areas of France, and many of which were a concern in Great Britain, that caused these countries to look at what could be done to ensure its safety through future generations.

²⁶ Alisa Klaus, *Every Child a Lion: The Origins of Maternal and Infant Health Policy in the United States and France, 1890-1920* (Ithaca: Cornell University Press, 1993), 5.

²⁷ Klaus, *Every Child a Lion*, 17.

²⁸ Klaus, *Every Child a Lion*, 24.

²⁹ Klaus, *Every Child a Lion*, 17.

Population Concerns and Children's Health

Public Health officials in both Great Britain and France believed that something needed to be done to ensure a healthy population for the future. Officials and researchers began to focus on children's health, hoping to guarantee the health of the future generation of soldiers assuming they would be needed. Susan Pedersen argues in *Family, Dependence, and the Origins of the Welfare State*, that the British state held the view that "a healthy population would preserve Britain's world position against its European competitors".³⁰ France also began to take this same viewpoint. In France, policy makers, doctors and politicians began to feel the need to produce a healthier population. Facing a declining birth rate and rising infant mortality rates, Klaus describes that:

"French observers pointed to the declining birthrate as both the cause and symptom of the nation's general physical and moral degeneration. They cited 'depopulation' as the cause of economic stagnation, as a sign of rampant individualism and the denial of family and patriotic responsibility, and, most important, as the cause of France's military defeat at the hands of Germany".³¹

As a result, French researchers began to focus on ways to not only decrease the infant mortality rate, but to also work to improve children's health to ensure stronger future generations that could compete with those of rival European countries.

William Schneider has shown that eugenics became an important part of this discussion with the intent of improving the "hereditary quality of the population" in *Quality and Quantity*.³² Worried that they were falling behind economic rivals such

³⁰ Susan Pedersen, *Family, Dependence, and the Origins of the Welfare State* (Cambridge: Cambridge University Press, 1993), 53.

³¹ Klaus, *Every Child a Lion*, 14.

³² William H. Schneider, *Quality and Quantity: The Quest for Biological Regeneration in Twentieth-Century France* (Cambridge: Cambridge University Press, 1990), 8.

as Germany, state officials in Great Britain and France believed that in order to improve not only the numbers in regard to population, they also needed to improve the quality of the population. Although other countries took different measures to achieve this, French public health officials thought that this betterment could be accomplished through measures that would encourage health and cleanliness. One example of this was to educate the public on health standards to create a healthier generation of children. It was thought that through this education, the children would be healthier and would carry this down through future generations, creating a higher quality of standards for these future generations. Schneider shows that although many of the reformers involved in maternal and infant/child welfare used a “medical model of national decline to explain both loss of national power and internal social problems such as crime, mental illness, alcoholism, and prostitution,” it was thought that through education and other welfare programs they could “increase the rate of population growth and influence the composition of quality of the population”.³³ Another aspect of the eugenics movement involved theories about heredity. Following the ideas of Jean Baptiste Lamarck, who believed that “acquired characteristics could be inherited” heredity became an important part of the discourse of eugenics and pediatrics.³⁴ Schneider shows that neo-Lamarckian thought became important to the theories of eugenics in France because it emphasized positive measures. With the population anxieties that France was facing, eugenicists wanted to concentrate on positive measures that would encourage marriage and procreation,

³³ Klaus, *Every Child a Lion*, 12.

³⁴ Schneider, *Quality and Quantity*, 6.

as well as increase the quality of the future generations. With the Lamarckian belief that traits were inherited, it was believed that “those wishing to improve the quality of future generations could do so by improving the environment and health of the present generation”.³⁵ These were just some of the ideas that were present before the Great War (1914-1918) which caused even more alarm in regards to Great Britain and France’s population anxieties.

During the Great War, the concern over population became critically important. In both countries, the extreme pressures on the male population reinforced the idea that a strong, thriving population would help Great Britain and France maintain their positions as world powers.³⁶ The losses of the war were horrific. In England, after the war, “although the general mortality rate was decreasing, the infant mortality rate was increasing. To make matters worse, the birth rate was also declining,”³⁷ which meant in population discourse that lives lost during the war were not being replaced. Through government interaction as well as concern from researchers and with help from the general public, policy makers in Great Britain and France both enacted policies to not only encourage a stronger, healthier future generation, but also to encourage families to take the initiative in helping their country by having children and keeping them healthy.

Maternal and Child Welfare

Maternal and child welfare policies became very important in Great Britain and France to address the declining birth rate. It was important to find a way to encourage

³⁵ Schneider, *Quality and Quantity*, 284.

³⁶ Dwork, *War is Good*, 6.

³⁷ Dwork, *War is Good*, 3.

women to continue having children, even if they were working or already had children. Concentrating on working women, public policy makers in both Great Britain and France had different approaches to encouraging women in the workplace to have or continue having children. One reason for this difference was that “women officially constituted 30% of the French labor force in 1866; by 1911, this figure had risen to almost 37%, compared with 29.6% in Britain”.³⁸ Due to the fact that a large portion of France’s workforce was made up of women, state officials in France created more welfare programs for working women that would encourage them not only to work, but also to have children and be able to care for them. Pedersen demonstrates that both of these countries had different outlooks on working women resulting in the few labor rights that were created at this time, “whereas British policymakers assumed that mothers with small children would only in exceptional circumstances be in the labor market, the French accepted that large numbers of married women would be ‘economically active,’” resulting in France creating more policy for working women.³⁹

One way that the French government achieved this was by reforming women’s labor rights. Klaus illustrates that French officials believed that “not only did infants die because their mothers gave up breast-feeding to place them out to nurse or leave them with a neighbor during the day, but the physical drain and in many cases physical injuries made women reluctant to become pregnant”.⁴⁰ Due to these quandaries, they tried to find ways in which women could keep their jobs as well as raise a healthy child. One technique to accomplish this was through the use of crèches or child care facilities.

³⁸ Pedersen, *Welfare State*, 70.

³⁹ Pedersen, *Welfare State*, 71.

⁴⁰ Klaus, *Every Child a Lion*, 27.

These ensured a clean environment for their children where they would also be able to nurse them. Although many argued that pregnant women or mothers should not work at all, others pointed out that they needed to work to survive and their labor was needed as well. As a result, protective measures would be put in place to ensure the health of the women. This was done by excluding them from strenuous tasks, enabling them time to nurse during the work day, as well as compensating them for maternity leave. They wanted to ensure that women were protected so they could perform their most important duty and raise healthy children for France.⁴¹

As Roger Cooter has shown, another important initiative in child welfare was a push to educate the public about how to keep children healthy. These ideas were put to work through medical professionals, mother's manuals, and the education system. One way that medical knowledge and sanitation awareness were spread was through the use of home visits by traveling nurses. Cooter shows that during these visits "women were trained to teach the prevention of disease through proper nutrition, cleanliness, sleep and exercise habits, clothing, and ventilation".⁴² As concern for the birth rate and infant mortality rate rose, the primary focus of these visiting nurses was maternal and infant welfare. One important concern addressed by traveling nurses was that of breast-feeding infants.

The topic of breast-feeding became very important to the discourse on infant health in the late nineteenth and the early twentieth centuries. In both countries, reformers believed that artificially feeding infants was a major cause of infant mortality.

⁴¹ Klaus, *Every Child a Lion*, 175.

⁴² Roger Cooter, *In the Name of the Child: Health and Welfare, 1880-1940* (London: Routledge, 1992), 71.

Believed to be one of the causes of the high infant mortality rate, tainted milk became a major concern to researchers, as well as to the government and the public. Dwork demonstrates that upon examination of the milk supply it was found to be contaminated and “by the early years of the twentieth century, it was well understood, albeit in a general way, that this pollution was harmful to the public health, particularly to the infant portion of the population”.⁴³ Due to this, researchers encouraged women to breastfeed their children and not wean them early to avoid the health risks associated with milk. Milk stations became important factors in helping to maintain maternal and infant health as well. Although breastfeeding was encouraged, milk stations were setup to provide a clean milk supply if breastfeeding was not an option. Breastfeeding was also encouraged by researchers in many of the mothers manuals published in the late nineteenth and early twentieth centuries.

Mother’s manuals were published and distributed, in Great Britain and France, as a way to educate mothers on how to properly care for their children. This was a very important focus at the time, because it enabled women to have some knowledge of what conditions were best to raise a healthy child, and also on how to identify and treat common maladies. Realizing that the infant’s health was in the hands of its mother, the British and French governments supported the distribution of the pamphlets in the hope of encouraging women to help increase the survival rate of infants and children throughout the country. Through these manuals the state and researchers “appealed to mothers of all social classes to recognize child-rearing as a matter of national rather than

⁴³ Dwork, *War is Good*, 53.

personal concern”.⁴⁴ These manuals also provided pregnant women with advice on how to have a healthy pregnancy that would result in a healthy infant.

The education system became another avenue of surveying and improving child health. Colin Heywood has traced the transition in France from a childhood focused on work to a childhood that focused on education. With a rising concern for children’s health due to a declining birth rate and increased mortality rate, many began to believe that education should be mandatory for children. With more children in school, it became important to transfer ideas on children’s health into the function of the school. Diet and disease being two of the most important factors in children’s health, policy makers made it necessary for schools to ensure that children were receiving the proper nutrition and medical treatment at the school.⁴⁵

After the Franco-Prussian War, and the population anxieties that arose, France put new education legislation into place that provided free mandatory schooling for children. It was decided that a nutritious hot meal needed to be given to the schoolchildren in order to keep them healthy. Through this and funding from the Paris municipal council, hot lunches were provided to those who could not afford them, and were available at a cost to those who could.⁴⁶ In Great Britain it was believed that “just as proper feeding was understood to be the primary factor in maintaining the health of infants and ensuring that they would thrive and grow, adequate nourishment was perceived as the key to preserving and even ameliorating the mental as well as the physical condition of school

⁴⁴ Cooter, *Name of the Child*, 177.

⁴⁵ Heywood, *Childhood*, 3.

⁴⁶ Dwork, *War is Good*, 175

children”.⁴⁷ Due to these beliefs, Great Britain also wanted to provide their schoolchildren with a nutritious hot meal, seeing the success that France had with their program, Great Britain used this as a model for providing their schoolchildren with meals. However, nutrition was not the only way that these countries encouraged healthy schoolchildren. Medical inspections also became an essential factor in schools.

Medical inspections became an important aspect of schooling in Great Britain and France at the turn of the twentieth century, as a result of population anxieties and a fear of the existence of an already unhealthy population. Through these medical inspections, researchers and state officials believed that it was necessary that “a medical officer be attached to each school, who shall inspect each class as it assembles to detect infectious or other diseases in the early stage, who shall examine the eyesight, the hearing, and general condition of each child”.⁴⁸ Medical inspections were important because they demonstrate the importance that infant and child health held within these countries. Great Britain and France were creating policy that not only supported the health of mothers and infants, but also continued into childhood.

In addition to the health of mothers and children, child abandonment was a growing problem in regards to population anxiety throughout Europe in the nineteenth century, and due to this new concern, legislation arose to address this matter. Rachel Fuchs has shown that public policy officials believed that it was important to provide support to these abandoned children in the hopes of creating a useful class of citizens for the future. This was a part of the eugenics discussion at the time, believing that it was

⁴⁷ Dwork, *War is Good*, 169.

⁴⁸ Dwork, *War is Good*, 187.

important to not only focus on encouraging women to produce new future generations, but also to ensure that the children already born would help contribute to these successful future generations.⁴⁹ Although policy officials encouraged single women to keep their babies, they knew it was still important to provide abandoned children with enough benefits that would ensure they could become part of the military or working class as they grew older. Through these beliefs, both the British and French government enacted policy that would benefit abandoned children throughout their nation.

As the following chapter will show, population concerns underscored the trepidations over infant health and disease. According to the discourse, it became imperative to not only encourage women to have children, but to also find ways to eradicate the diseases which were affecting infants and children during this time. Ideas on how to decrease the child mortality rate became essential and focused on helping sick children and infants as well as keeping children healthy. Researchers worked to better understand these diseases, their causes, symptoms, the ways they affected the patient, their mortality rate, as well as what treatments worked best for each disease. Although infant diarrhea and tuberculosis had some of the highest infant mortality rates alone, other diseases also became important for researchers in the quest to ensure a healthier baby.

Researchers in Great Britain and France examined rickets, its various explanatory models of causation, the understanding of symptomatic diagnosis, and how treatment methods developed throughout the late nineteenth and early twentieth centuries. A comparative focus will show that although Great Britain and France were facing common

⁴⁹ Rachel Fuchs, *Abandoned Children: Foundlings and Child Welfare in Nineteenth-Century France* (Albany: State University of New York Press, 1984), 196.

concerns over populationism and children's health, both had different research paths in regards to rickets, as well as the different explanatory models for the disease. These research paths and explanatory models, as will be shown in the next chapters, were determined by each country according to the factors that helped frame how they addressed the disease. As stated above, population concerns and children's health were important parts of the framework in both countries, as was poverty. However, in Great Britain, industrialization played a role in the way rickets was framed, while in France, heredity provided the framework for how physicians, researchers, state officials, and society addressed the disease. Both countries had different elements that contributed to the anxiety over children's health, the place of children in society, general disease and health concerns regarding child health and policies during the late nineteenth and early twentieth centuries.

Chapter Two

Rickets in Great Britain: Pediatric Hospitals and Lion Cubs

In Great Britain, during the late nineteenth and early twentieth centuries, rickets became one of the main diseases to become a central concern regarding children's health. As discussed in Chapter One, population anxieties developed due to rising fears over health and mortality rates relating to the Boer War along with declining birth rates and rising infant mortality rates, which led Great Britain to examine children's health in greater detail. One important aspect of this was the role that the medical communities played in not only diagnosing and treating the children suffering from rickets, but also in working to find the cause of the disease and attempting to eradicate rickets from Great Britain.

Medicine and the Role of Hospitals in Great Britain

There were many factors that played into how physicians and researchers interacted with patients and diseases during the late nineteenth century that had a great impact on how the problem of rickets was approached. One theory that had a great effect on the ideas and treatment regarding rickets was the germ theory of disease. While the theory of miasma (contaminated air) was prominent in the mid-nineteenth century, by the 1860's the rise of bacteriology and the germ theory led scientists and researchers to look at diseases in different ways.⁵⁰ Some researchers began to look at the environment of the infant and child in the belief that germs were possibly playing a role in the development

⁵⁰ Roy Porter, *The Greatest Benefit to Mankind: A Medical History of Humanity* (New York: W.W. Norton & Company, 1997), 10.

of rickets. The germ theory's influence can be seen through some of the primary sources that will be discussed. Researchers believed that the germ-ridden, unsanitary living conditions contributed to the causation of rickets. With the argument that germs were responsible for rickets, some researchers laid out a plan to ensure that the child was living in a clean environment. Germ theory and the theory of miasma, while not as prominent concerns as diet and climate, were still considered by some researchers to be the cause of rickets. However, with the full realization of the causation of rickets, the treatment for this disease turned more into a look at how diet could affect the human body.

Another important aspect of medicine in Great Britain was the rise in the prominence of the hospital, and the establishment of the specialized children's hospital. Although hospitals had been around since medieval times, it was during the nineteenth century that hospitals became central to research in both Great Britain and France.⁵¹ Hospitals became the main point of interaction between patients and doctors. Doctors were able to see a larger number of patients and also had access to them during their stay at the hospital. This made observation of the patient and the disease much easier. As shown by Roy Porter in *The Greatest Benefit to Mankind*, while individual medicine had been important up until the nineteenth century, during the nineteenth century, hospitals became the focus of medicine. He stated, "Hospitals were such a decisive factor in the development of early nineteenth-century medicine that this particular period might as well be characterized as the period of *hospital* medicine".⁵² Researchers during the late nineteenth century realized the importance of providing separate care for children,

⁵¹ Erwin H. Ackerknecht, *A Short History of Medicine* (Baltimore: The Johns Hopkins University Press, 1982), 92.

⁵² Porter, *Greatest Benefit*, 146.

therefore the specialization in children's health and children's hospitals began to emerge. As shown by Janet Golden, one of the most important aspects of this, in regards to rickets as well as other childhood diseases, was the establishment of the children's hospitals which made it possible for researchers to study these diseases in greater detail, noting symptoms that became evident over time, in a larger number of patients.⁵³ These were not the only changes taking place at this time however.

It was also throughout the nineteenth century and into the twentieth century that modern scientific medicine began to take shape, which emphasized experimentation and case studies.⁵⁴ As shown by W.F. Bynum in *Science and the Practice of Medicine in the Nineteenth Century*, experimentation became an important aspect in better understanding many diseases in Great Britain, and rickets was no exception. Through this process, ideas such as germ theory were formed, and more was discovered about the course of individual diseases. Though clinical observation was also an important aspect of medicine during this time, experimentation helped discover the causation and treatment for many diseases.⁵⁵ One of the most important facets was experimentation on animals. These experiments were important because researchers and scientists were able to create and attempt to treat a disease in a controlled environment, without having to test their methods on humans. However, not all people were happy with experimentation or, as it became known, vivisection on animals. In Great Britain antivivisection campaigns took

⁵³ Janet Golden, *Infant Asylums and Children's Hospitals: Medical Dilemmas and Developments 1850-1920* (London: Garland Publishing, 1989), 1.

⁵⁴ Michel Foucault and his discussion of clinical medicine, while important to the field, will be discussed in Chapter Three and the influence of clinical medicine in France.

⁵⁵ W.F. Bynum, *Science and the Practice of Medicine in the Nineteenth Century* (Cambridge: Cambridge University Press, 1994), 170.

place to stop the use of animals in medical experiments. In 1876 the Cruelty to Animals Act was created as a truce between the scientific community and those that opposed animal cruelty. Through this act limits were set on the use of animals, and the proper conduct for experiments that used animals. It also required the researchers or scientists to register with the Home Office before any research with animals could be conducted.⁵⁶ Though Great Britain was the only country to enact such a law, it did not stop scientists and researchers from performing medical experiments on animals, many of which, such as those concerning rickets, led to great discoveries in the medical field. It was through the different aspects of medicine such as publications, clinical studies, and experimentation, that the causation and treatment for rickets was discovered.

Medical Perspectives on Rickets in Great Britain: 1860-1930

Through medical publications written by researchers from the late nineteenth and early twentieth centuries, a picture of the symptoms, diagnosis, models of causation, and treatment, can be seen in regards to rachitic children. These works show not only what was done for these patients, but also how changing ideas affected explanatory models of the disease and its treatment. One influential publication on the diseases of children in the last half of the nineteenth century was *Diseases of Children: A Clinical Treatise Based on the Lectures Delivered at the Hospital for Sick Children, London* by Dr. Thomas Hillier (1830-1868), published in 1868. This publication, which began as a series of lectures but was expanded by Hillier, is an early example of not only the rise of interest in children's health, but also the clinical observation methods used by

⁵⁶ Bynum, *Science and Medicine*, 168.

researchers. Hillier recognized the debt his research owed to the children's hospital.

This is illustrated by the foreword of this publication that discussed Hillier's work at the hospital:

“Until recently the opportunities for the clinical study of infantile maladies in this country have been very few. The establishment of the Hospital for Sick Children has served to direct attention to the necessity of affording facilities for this study. Several of the general hospitals in London have recently opened children's wards, and hospitals for children have been established in some of the larger provincial towns of the kingdom”.⁵⁷

Hillier's work on rickets provides an early example of how researchers observed rickets in the late nineteenth century. One important aspect of Hillier's work is the fact that he states that rickets is a problem in Great Britain despite the fact that the number of deaths reported from it is small compared to some of the other infant and childhood diseases. In his view, rickets possibly was a causal factor in other often fatal conditions within the infant/child population, such as bronchitis, atrophy, and convulsions, all conditions that were regularly registered as the cause of death. This made it difficult to get an accurate estimation of the number of deaths caused by rickets each year.⁵⁸ It will be seen with later works as well that deaths were often attributed in the register to the immediate cause of death, rather than the chronic disease that was the underlying cause, making accurate estimations of rickets difficult.

Although researchers from the 1860's through the 1930's were well aware of the symptoms of rickets, they could often be mistaken for other diseases. As described by Hillier, by the 1860's the symptoms were generally known by researchers, though they

⁵⁷ Hillier, *Diseases of Children*, foreword.

⁵⁸ Hillier, *Diseases of Children*, 78.

could still be confused with diseases such as tuberculosis. For Hillier, early signs of the disease were that the child began to walk much later than other children or not at all, they also cut their teeth much later or would have faulty teeth; gastrointestinal problems were also seen as a problem, along with typical bone and muscle deformations seen throughout the body. Some of the most notable of these often included an enlarged head; bead-like thickening on the bones, especially the ribs (called rachitic rosary); pigeon-breast or keeled sternum; bow-legs; and a prominent and protruding abdomen.⁵⁹ These are just some of the outward noticeable indications of the disease that were seen, along with a general bending of the bone.

The debate over heredity as a causal factor was important in research publications from the 1860's through the 1930's in both Great Britain and France. While opinions on this matter varied between researchers, a general consensus was formed in both Great Britain and France, though their ideas on this matter were very different. In Great Britain, as demonstrated by Hillier, heredity was debatable, with most British researchers observing that the case for rickets as a hereditary disease was not very strong among their clinical observations. Hillier explained that although other researchers, such as Herring and von Rittershain, believed that rickets was hereditary, his own observations at the children's hospital did not provide a solid conclusion.⁶⁰ He stated that through the cases he had observed at the hospital there was a high likelihood that if a child had rickets, its mother had in the past, but he said this was not true among all cases and that it was

⁵⁹ Hillier, *Diseases of Children*, 78-79.

⁶⁰ Hillier, *Diseases of Children*, 80.

mostly seen among the poor. Hillier stated that in regards to rickets being hereditary it was “generally believed not to be so”.⁶¹

Against heredity Hillier posed four causal factors: unsuitable food (including “artificial feeding” of infants)⁶², impure air, want of light, and a lack of earthly salts (lime salts)⁶³. Hillier argued that artificial feeding was one of the most important causes of rickets, and that the lack of breast-milk or insufficient breast-milk was a factor. He argued that insufficient breast-milk that did not contain enough “earthly salts” or that contained “too much water” which caused a faulty diet for infants and contributed to rickets.⁶⁴ In order to regain these nutrients, Hillier suggested a treatment plan that would supplement these earthly salts back into the diet. Hillier said that cod liver oil was one of the best solutions because he believed that it contained enough “earthly salts” to help revive the children’s diet.⁶⁵

Another researcher who focused on children’s health in the late nineteenth century was Dr. James Frederic Goodhart (1846-1916). In *The Diseases of Children* (1891), Goodhart examined various children’s diseases, their etiology, symptoms, diagnosis, and treatment. His examination of rickets shows what ideas about rickets had changed since Hillier’s work and demonstrated how these ideas fit in with medical understandings in the last decade of the nineteenth century. Although over twenty years

⁶¹ Hillier, *Diseases of Children*, 80.

⁶² When Hillier refers to “artificial feeding” he is talking about any feeding method of the baby other than breast-feeding, primarily bottle-feeding with cow’s milk.

⁶³ Hillier discusses “earthly salts” or “lime salts” as having phosphate of lime in his work, but does not give a detailed account of what earthly salts are or consist of, 86.

⁶⁴ Hillier believed that breast-milk was insufficient when it contained too much water. He believed that sufficient breast-milk was 86% water, while insufficient breast-milk was made of 90% or more water, 81.

⁶⁵ More information on cod liver oil will be seen in Chapter 3.

passed between this publication and Hillier's, observations on rickets, its causation, and its treatment did not really begin to change until the 1890's.

Goodhart's work showed the widespread influence of germ theory. He agreed with Hillier about fresh air, but put emphasis on hygiene rather than diet. He argued that the child must be raised in a hygienic, germ-free environment. Through the belief that rickets was formed in unsanitary conditions Goodhart laid out a "common-sense" plan which he believed should be followed by those wishing to prevent rickets in children. His plan stated:

"cleanliness to the most minute detail, should be enforced; a tepid bath should be given night and morning; there must be no stint in the changes in the child's under-linen and napkins; cleanliness must be observed in its bedding; cleanliness in its food and feeding apparatus; and its clothing must be thoroughly warm, yet not oppressive. The air the child lives in must be attended to. The garret near the sky, dark, hot, and stuffy, is not the place for the nursery. To prevent rickets, the rooms inhabited by the child must be well-ventilated, not draughty, and though warm, never hot".⁶⁶

Goodhart believed that if all parents followed this plan that children would not develop rickets. In the instance where a child did develop the disease, Goodhart also emphasized diet as treatment, showing that diet was still important. He recommended milk, meat, gravy, and vegetables believing this diet would help children overcome rickets. But, like Hillier, he emphasized that the best treatment was cod liver oil. Unlike Hillier, however, who thought that it provided "earthly salts" to a diet, Goodhart believed that it was successful because of the fat content.⁶⁷

⁶⁶ James Frederic Goodhart, *The Diseases of Children* (London: J&A Churchill, 1891), 738.

⁶⁷ Goodhart, *Diseases of Children*, 721.

With the turn of the twentieth century new ideas on children's health began to arise, in part because of new discoveries concerning diet and disease. One researcher who demonstrates these changes is David Forsyth (1880-1946) in *Children in Health and Disease: A Study of Child-Life* published in 1909. Although written over forty years later than Hillier, Forsyth's work reflects some of the same ideas. Like Hillier, he believed rickets was still under reported although it was one of the most deadly diseases of infancy and childhood. Many children died due to other diseases such as diarrhea or broncho-pneumonia that commonly occurred in children with rickets.⁶⁸ This is a fact that is acknowledged by many of the researchers writing during this time. Though rickets was proven to be prominent in the late nineteenth century, the statistical records do not yet indicate that the disease was significant among children.

Forsyth also points out that one of the more poignant correlations between nutrition and rickets was found in the cases of abandonment of illegitimate children, who were often malnourished in orphanages. Forsyth illustrated that children born out of wedlock had a 50 per cent higher mortality rate due to childhood diseases than legitimate children; this point is illustrated in the case of malnourishment in orphanages.⁶⁹ Aiming to prevent these abandoned children from becoming adult degenerates, the issue of malnourishment and rickets became a growing public concern.

Like Hillier and Goodhart, Forsyth believed that rickets was a disease of nutrition. Forsyth implicated the deficiency of a nutritive value, though he did not discuss what he

⁶⁸ David Forsyth, *Children in Health and Disease: A Study of Child-Life* (Philadelphia: P. Blackiston's Son and Company, 1909), 232.

⁶⁹ Forsyth, *Children in Health and Disease*, 225.

understood that to be. The most important evidence for this deficiency was the higher rate of rickets among children not breast-fed. Like most researchers at the time, he thought that infants that were raised on artificial milk were not receiving essential nutrients making them more prone to develop rickets. Like Hillier, he felt that breast milk could be insufficient in quality or quantity. He showed that this was a problem that could be corrected by supplemental sterile milk and adding other nutrients into the diet.⁷⁰

An important aspect to consider when discussing rickets in Great Britain was how the Industrial Revolution fit into the causation and occurrence of rickets. While others before him, such as Hillier and Goodhart, had only briefly mentioned that it seemed more of their cases were from town-born children, Dr. Forsyth states that it is the towns and cities, especially those that were industrialized that suffered the greatest threat from rickets.⁷¹ Knowing today that rickets is a disease caused by a faulty diet lacking sufficient quantities of Vitamin C, Vitamin D or from lack of sunlight, it is easy to see the role industrialization played in regards to the disease. Children living in these cities did not receive an adequate amount of sunshine due to the smoggy conditions produced by industrialization. Burning coal created problems “such as sulfur dioxide and other emissions, produced the infamous London smogs of the nineteenth and twentieth centuries. The particles in the air caused irritation to the lungs and blocked both visible and invisible radiation from the sun. The London smog was an effective sunscreen”.⁷² However, the statements made by Forsyth illustrate that though researchers realized that

⁷⁰ Forsyth, *Children in Health and Disease*, 253.

⁷¹ Forsyth, *Children in Health and Disease*, 255.

⁷² Frances Rachel Frankenburg, *Vitamin discoveries and disasters: history, science, and controversies* (Santa Barbara, Calif.: Praeger/ABC-CLIO, 2009), 98

rickets was a problem in these areas, they were not sure why this was the case, and believed that it had more to do with overcrowding compared to anything else. Dwork and Klaus point out that this on top of the fact that many of these cities were filled with women workers who could not breast-feed their babies, and also families who could not afford much more than bread for their children that greatly contributed to the number of rickets cases in the cities during the start of the twentieth century.⁷³

Before Forsyth, other research had brought attention to industrialization and disease. Several years before Forsyth's findings, in 1889, Dr. Isambard (1850-1927) Owen published the *Reports of the Collective Investigation Committee of the British Medical Association concerning the Geographical Distribution of Rickets, Acute and Subacute Rheumatism, Chorea, Cancer, and Urinary Calculus in the British Islands*. In this report, Owen examined where these diseases occurred and in what concentration, to obtain a better understanding of the possible impact of location on disease. This report was ordered by the Medical Congress of 1884 to get a better understanding of the etiology of these diseases.⁷⁴ In order to carry out this investigation, an inquiry paper was sent out to every registered medical practitioner. Over 3,000 were returned in the United Kingdom.

⁷³ Klaus, *Every Child a Lion*, 251

⁷⁴ Isambard Owen, *Reports of the Collective Investigation Committee of the British Medical Association concerning the Geographical Distribution of Rickets, Acute and Subacute Rheumatism, Chorea, Cancer, and Urinary Calculus in the British Islands*. *The British Medical Journal* (Vol. 1 No. 1464. Jan 19, 1889), 114. Also goal of the Medical Congress of 1884 was to expand on the information collected by the British Medical Association in regards to etiology and geographical distribution. While the initial goal was to expand this throughout out, limited funding made it possible to accomplish this task in Great Britain, Denmark, Sweden, Norway, and the United States.

Through his investigation Owen made some very important discoveries about the distribution of rickets throughout the United Kingdom. In order to keep track of his discoveries, he created maps for each of the diseases and plotted where it was present. Blue stood for places where the disease was present, red for places that it was not, and purple was assigned to places that returned conflicting reports. Through this, Owen discovered that in rickets (as in some other diseases) the blue was most dominant in industrialized cities. He stated “that rickets, though not unknown in rural districts, is mainly a disease of towns and industrial regions, and especially of large industrial towns; that it is rare in the rural districts of Scotland, the North of England, North Wales and Ireland, Ulster excepted”.⁷⁵ Though the reasons for this predominance of rickets in industrialized cities were not fully comprehended at the time, it is important to realize that from the late 1880’s it was known that rickets occurred more frequently in industrialized cities, and more rarely in rural areas of Great Britain. Today, as shown by Anne Hardy, we know that rickets in industrialized cities was “brought about partly by the dense pall of smoke which both industry and domestic heating arrangements generated, but the effects of air pollution were compounded by domestic circumstances and social practices”.⁷⁶ These practices included “building practices which excluded sunlight from the home; popular concepts of respectability; and the constraints which kept young children indoors – young mothers lacking in vitality, tenement accommodation, poverty and ignorance; all played a part”.⁷⁷

⁷⁵ Owen, *Geographical Distribution of Rickets*, 114.

⁷⁶ Hardy, *Rickets and the Rest*, 398.

⁷⁷ Hardy, *Rickets and the Rest*, 398.

Two years after Isambard Owen made his observations regarding how rickets was more prevalent in industrialized cities, a Scottish medical missionary, Theobald Palm (1848-1928), decided to see where rickets was most prevalent throughout the world. In order to accomplish this Palm created a questionnaire that discussed rickets and where it was located, and sent this to other medical missionaries in Tibet and China. The returned questionnaires demonstrated to Palm that in countries where sunshine was abundant the incidence of rickets was low, despite the fact that many of these children lived in poverty. However, in northern industrialized cities where sunshine was scarce, rickets was found in abundance. Another part of the survey discussed the role of breastfeeding, and it was through this that Palm discovered that rickets developed primarily in children who were not breastfed and who were not exposed to sunlight.⁷⁸ Through her work, Frances Rachel Frankenburg shows that these men's ideas were accurate in regards to sunlight and rickets; however due to lack of interest their ideas were not further pursued.

The early twentieth century was characterized by the ongoing attempts to find the specific cause of rickets. In 1919, Dr. James Burnet (1856-1932) published the *Manual of Diseases of Children*, which continues with the idea that artificial feeding of infants is the chief cause of rickets. Burnet makes a very interesting observation when he stated that as long as breast-fed infants have ample amounts of fresh air and sunlight they will not develop rickets.⁷⁹ Here, Burnet shows a changing idea on breast-feeding, which demonstrates that breast-milk alone is not enough to prevent rickets, but needs to be supplemented by other remedies. While early publications showed that breast-fed babies

⁷⁸ Frankenburg, *Vitamin Discoveries*, 98.

⁷⁹ James Burnet, *Manual of Diseases of Children* (Edinburgh: E&S Livingstone, 1919), 104.

did not develop rickets compared to artificially fed infants, unless the mother's milk was faulty, Burnet argues that sunlight is also an important factor in the quest to eliminate rickets from children. He implicated, "bad hygiene, overcrowding, and want of fresh air," as well as, "sunlight, and exercise" as "contributory causes".⁸⁰ He also stated that "rickets is also fairly common in premature infants".⁸¹

By Burnet's time there was a clear regimen for treatment and a rationale for that treatment. Burnet stated that many of the cases that he had worked with made an excellent recovery as long as they were treated early and properly. For his treatment plan, Burnet said that the most important aspect to recovery was to address the diet of the infant. He argued that one of the most important aspects of the diet that a child with rickets was lacking was fat. Due to this, fat had to be assimilated into the diet in order to help the infant or child recover. This could be done through the use of plain cod liver oil or a cod liver oil emulsion. He stated that "in regulating the diet of rachitic infants who are over a year old, we should endeavor to supply as much fat as possible, not only by giving cod-liver oil, or Virol, but also by introducing it into the actual diet of the patients".⁸² Although it was not known during this time precisely what factors in cod liver oil produced significant positive results, it is important that these researchers realized that it produced results in rachitic infants and children when used to supplement their diet.

⁸⁰ Burnet, *Diseases of Children*, 104.

⁸¹ Burnet, *Diseases of Children*, 104.

⁸² Burnet, *Diseases of Children*, 110.

Experimental Rickets in Animal Subjects

Children were not the only victims of rickets during this time. Burnet, Hillier, and Goodhart who wrote on rickets as part of their general treatises on childhood diseases all reflect a multi-causal view of rickets. However, several researchers applied experimental methods, especially to animal subjects, in order to find a more precise understanding. Animals suffered from the disease as well, and it was through this problem that many advancements were made concerning its causation and treatment. One particularly troubling case of rickets, as told in *Vitamin Discoveries and Disasters*, by Frankenburg, that made a huge difference in the treatment of rickets throughout the world, revolved around the lion cubs featured at the London Zoo in 1889. At that time, all litters of lion cubs born at the London Zoo had died due to rickets.⁸³ In order to help find the cause of this problem and help with a solution, the London Zoo officials called in John Bland-Sutton (1855-1936), a researcher in London. Realizing that the diet of the lion cubs was insufficient compared to what they would have consumed in the wild, Bland-Sutton created a diet plan for them that would try to bridge these gaps in their diet. Bland-Sutton noticed “that the cubs were fed lean meat. This seemed wrong to him because, in their natural habitat, lions do not just eat part of their prey. They eat small animals whole, including their organs and bones”.⁸⁴ He created a diet consisting of goat flesh and bones, as well as milk and cod liver oil to supplement their diet. When given this diet consistently the lion cubs began to grow healthy and the litters began to survive. Although Bland-Sutton did not publish his findings, according to Frankenburg they were

⁸³ The deaths of the lion cubs, as shown by Frankenburg was due in part to a faulty diet, and also due to a lack of sunshine because of the industrial conditions of London as mentioned earlier. Frankenburg, 99.

⁸⁴ Frankenburg, *Vitamin Discoveries*, 99.

well known in the medical community. It was through this that others experimenting on finding the causation and cure for rickets would examine what in cod liver oil contributed to the recovery of rachitic animals.⁸⁵

Researchers believed that they could isolate the cause of the disease by examining the different factors and trying to apply those to test subjects. Due to this, the English Medical Research Committee began to search for a researcher who could carry out the work of studying rickets.⁸⁶ It was through this that Dr. Edward Mellanby (1884-1955), in 1914, began a series of experiments that would greatly contribute to the knowledge of rickets and its causation.

Mellanby knew that in order to find the causation of rickets he would have to turn to experimental medicine, since observational clinical medicine had not produced any definitive results. Mellanby decided that the best way to do this would be to use animals who when diagnosed with rickets exhibited the same symptoms present in those of rachitic children. He stated that “it would be of greater advantage in the first place to find a method of producing the disease with certainty in animals and to proceed from that point”.⁸⁷ Mellanby decided to use puppies since the appearance of rickets in a puppy was comparable to that of a human child. He also realized that in order to get accurate results from these experiments he would need to experiment with puppies from the same breed

⁸⁵ Frankenburg, *Vitamin Discoveries*, 99.

⁸⁶ Edward Mellanby, *Experimental Rickets: the effect of cereals and their interaction with other factors of diet and environment in producing Rickets* (London: H.M. Stationery Off., 1925), 4. The English Medical Committee was formed to initiate and help fund medical research, in the case of Edward Mellanby and rickets, the Committee wanted Mellanby to research the cause or causes of rickets.

⁸⁷ Edward Mellanby, *Nutrition and disease; the interaction of clinical and experimental work*. (Edinburgh: Oliver and Boyd, 1934), 1.

and litter. Over a course of five years and 400 rachitic puppies, Edward Mellanby was able to come up with the most accurate understanding of rickets up until the 1920's.⁸⁸

Mellanby wanted to determine if rickets was a hereditary disease, an infectious disease, one of diet, or caused by a deficiency of exercise, or if it was caused by some combination of these factors. These were issues that were proposed as causes in the literature as we have seen. First he looked at heredity. He separated puppies from the same litter into groups of those who would receive a rickets producing diet and those who would receive an anti-rickets diet. Mellanby was able to clearly distinguish that it was an environmental factor that introduced rickets, and not heredity as some still believed.⁸⁹

Another topic addressed by Mellanby revolved around whether there was a “domestication” factor in rickets, in other words, if rickets was specifically caused by confinement or lack of fresh air.⁹⁰ Mellanby thought that it was important to address this idea due to some experiments conducted by Dr. Lionel Findlay in 1908. Findlay's study revolved around diet and exercise and argued that it was actually exercise that prevented rickets and not the diet. Findlay's experiment consisted of keeping two groups of puppies on the same diet of milk and porridge. One group was confined in a small dark room, while the other group was allowed to run around outside. Findlay believed that he had demonstrated that it was actually the confinement and lack of exercise that caused rickets to develop and that diet and vitamins had nothing to do with the results. Mellanby believed that Findlay's experiments were not adequate, and still maintained that a dietary

⁸⁸ Mellanby, *Nutrition and Disease*, 1.

⁸⁹ Mellanby, *Experimental Rickets*, 5.

⁹⁰ Mellanby. *Experimental Rickets*, 56.

deficiency such as a vitamin was the primary causal factor of rickets.⁹¹ He addressed this debate about vitamins, diet, and exercise at the Royal Society of Medicine symposium on vitamins in infant feeding in 1920. At the symposium, “Mellanby rejected exercise as a ‘prime factor’ in rickets and argued that the ‘inhibitory effect’ of exercise in pups could be discounted in children,” and demonstrated that lack of exercise could not be to blame because, “rickets could develop in six-month-old babies and so, he argued it was difficult to see how ‘more running about’ could prevent it”.⁹² Mellanby was able to show that although confinement did play a role it could be compensated for by a change to the puppies’ diet. This debate between researchers such as Findlay and Mellanby about the role of vitamins, diet, and exercise was one that lasted even after the discovery of Vitamin D in 1922.

Mellanby also addressed the issue of rickets as an infectious disease. By keeping the puppies in close proximity to one another, Mellanby was able to show that the puppies did not seem to transmit the disease, showing that it was not communicable. Mellanby was able to provide a more accurate answer in regards to the experiments that he conducted showing that the disease was not infectious or hereditary. He also held that he had demonstrated that exercise itself had no effect.⁹³

The most important aspect of Mellanby’s experiments on puppies was the discovery he made in regards to diet and rickets. Mellanby tried different aspects of diet to see what worked in curing the puppies’ rickets. He found that in puppies six to eight

⁹¹ Mellanby, *Experimental Rickets*, 56.

⁹² Smith and Nicolson, *The Glaswegian Opposition*, 56.

⁹³ Mellanby, *Experimental Rickets*, 71.

weeks old, rickets developed with a diet of a limited amount of milk, and an excessive amount of bread or oatmeal. He also found that removing the fat from the milk made rickets develop at a faster rate.⁹⁴ One experiment that Mellanby tested was replacing the fat with linseed oil, since it was widely known that cod liver oil helped cure rickets, though the reason why was unknown. Linseed oil did not produce the same results as cod liver oil, but instead “the disease progressed as rapidly as if no fat had been given”.⁹⁵ For Mellanby this showed that fat was important to the diet, but that it was something specifically in cod liver oil that produced an anti-rachitic effect. Another important factor that Mellanby discovered was that even though calcium played an important role in the diet, it was not the main factor in the cause of rickets. He stated that “since the calcium and phosphorus intake of all the animals in a given series was the same, it was obvious that neither the amount nor the ratio of these elements ingested held the key to the situation”.⁹⁶ Knowing that a certain fat in cod liver oil was probably the key, Mellanby believed that it was probably a vitamin that was missing from the diet of these children, and thought that it was maybe a Fat-soluble Vitamin A.

Mellanby began to separate the factors used in his experiments into whether they prevented or created rickets. He found that factors that prevented rickets included: something associated with certain fats that were identical with the Fat-soluble Vitamin A such as cod liver oil, outdoor exercise, plenty of calcium and phosphorus in the diet, and meat. Factors that created rickets included: an excess of bread, cereals, or carbohydrates, absence of meat, confinement, deficiency of calcium and phosphorus, and a deficiency of

⁹⁴ Mellanby, *Experimental Rickets*, 65.

⁹⁵ Mellanby, *Nutrition and Disease*, 2.

⁹⁶ Mellanby, *Nutrition and Disease*, 3.

fat that contained the anti-rachitic vitamin.⁹⁷ This was a very important discovery as can be seen by examining the medical publications from the 1860's through the 1920's.

These researchers, while aware that cod liver oil was beneficial to the recovery of children with rickets, did not understand what is was in the oil that had the anti-rachitic effect. Some such as Dr. Hillier believed that it was a lack of "earthly salts" and that this was what cod liver oil contained, others such as Dr. Burnet believed that it had to do with fats, but did not realize that it was due to a vitamin deficiency. While Dr. Mellanby did not know exactly what vitamin was deficient in the diet, though he believed it was related to Fat-soluble Vitamin A, he did change how rickets was viewed and treated and paved the way for other scientists to work in discovering exactly what vitamin was missing from this diet. His work on diet and disease also helped researchers create a more effective diet to aid in preventing rickets in children.

Focusing on Children's Diet

Even while the exact cause of rickets remained murky, substantial progress was made against rickets because of the general focus on children's health and the specific concern with children's diseases. As mentioned in Chapter One, the medical community was not the only one taking preventive measures in regards to rickets. New medical and state initiatives also focused on infant and child health, and mothers and the school systems were also involved in trying to protect their children from succumbing to these dangerous childhood diseases. Publications such as mother's manuals and reports on the health and safety of schools demonstrate how important the idea of health, diet, and

⁹⁷ Mellanby, *Experimental Rickets*, 74.

disease were to the public throughout Great Britain in the late nineteenth and early twentieth centuries. Looking at different examples throughout my selected time period will emphasize change over time. They also show how ideas, such as those on diet and exercise, were being applied throughout Great Britain.

The main focus for women caring for children's health at home was to maintain a healthy diet. One method for accomplishing this task was by creating mother's manuals that discussed the ways mothers could keep their children healthy and free from diseases such as rickets. *The Mother's Manual of Children's Diseases* (1889) by Dr. Charles West M.D. (1816-1898), focused on the medical aspect of keeping children healthy. West's purpose in this handbook was "to give a description of the diseases of early life, such as may help a mother to understand something of their nature and symptoms, to save her from needless anxiety as to their issue, and to enable her wisely to second the doctor in his endeavours for their cure".⁹⁸ West accomplished this by laying out the different causes of mortality in children and the ways that this could be avoided. He taught mothers to look for symptoms of disease by listening to the cry of the infant or child, taking the temperature, feeling the pulse and listening to the breathing of the infant or child. If the situation was one that was manageable, the mother would proceed with a treatment of medicine, cold or heat applications, baths, or leeches, depending on the symptoms.⁹⁹ If however, the situation was not manageable by the mother, he described how important the role of the doctor could be and why it would be necessary to visit one. West also laid out ways for the mother to keep her child healthy. These included keeping

⁹⁸ Charles West, *The Mother's Manual of Children's Diseases*. (London: Longmans, Green and Co., 1885), Book Advertisement at beginning of book.

⁹⁹ West, *Mother's Manual*, 5-12.

a clean house, breastfeeding, and diet. Anne Hardy demonstrates that, “while it is impossible to assess what kind of impact, if any, West’s teachings had on domestic practice, he was certainly influential in the medical sphere”.¹⁰⁰ Although his work may have had little to no impact, West was important to children’s health not only because of his influence in the medical sphere, but also because he made his findings available in these mother’s manuals.

Another manual was *The Hygiene of Women and Children* (1921) by Janet Elizabeth Lane-Claypon Forber (1877-1967). Written by a woman thirty years after the previous example, it gives a different perspective on the hygiene of children compared to the perspective of the male doctors. Forber addressed the need for a garden. She believed that it was important for women and children to eat fresh food.¹⁰¹ She also addressed the storage of food and milk, including the heating of milk to kill bacteria, as well as the need for fresh air and ventilation.¹⁰² Forber also examined the diet of children after infancy and the process of weaning. She argued that for a child to have a healthy diet they should eat bread, fruits and vegetables, as well as milk and milk custards so that they are getting some fat in their diet.¹⁰³

One important initiative was ensuring that children received the diet recommended by researchers for the prevention of these diseases, and that was accomplished by offering proper nutrition in schools. Concern arose over the health/hygiene environment at school. This was addressed by researchers through

¹⁰⁰ Hardy, *Rickets and the Rest*, 410.

¹⁰¹ Janet E Lane-Claypon Forber, *Hygiene of Women and Children* (London: Henry Frowde and Hodder & Stoughton, 1921), 6.

¹⁰² Forber, *Hygiene*, 40.

¹⁰³ Forber, *Hygiene*, 303.

publications that discussed the diet of children's lunches at school, as well as monitoring illness in children at school. *The Essentials of School Diet or the diet suitable for the growth and development of youth* (1891) by Dr. Clement Dukes M.D. (1845-1925) was one of these publications. Dukes discussed the suitable diet and nutrition for the different levels of childhood, and what was necessary for the highest development of youth. He described what the schools should be feeding the children, how the purchasing of the food should be done, how the food should be prepared and how the food should be stored. He demonstrated how diet affected a child's height and weight.¹⁰⁴ Through this he demonstrated how important children's health was not only to parents and researchers, but also how this would be addressed in state run institutions such as schools.

In 1906 Parliament passed the provision of Meals Act, which put diet in legislation.¹⁰⁵ Another publication that addressed some of these matters was *Rearing an Imperial Race: A Full Report of the Second Guildhall School Conference in Diet, Cookery, and Hygiene* (1913) by Charles E. Hecht (1866-1942). This publication was based on a conference held by the Second Guildhall School. Hecht discussed the Provision of Meals Act of 1906 and the effects it had on school diet as well as the importance of not just providing a healthy diet and environment, but also teaching students to continue these ideas at home.¹⁰⁶ Diet however was not the only concern being

¹⁰⁴Clement Dukes, *The Essentials of School Diet or The Diet Suitable for the Growth and Development of Youth* (London: Percival and Co., 1891), 22-25.

¹⁰⁵ The Provision of Meals Act was created to ensure that children were able to take advantage of their education, making meals available and provided for at the school, making their education and meals supported by the state. It ensured that children suffering from malnutrition were properly fed at the school, 21.

¹⁰⁶Charles E Hecht, *Rearing an Imperial Race: A Full Report of the Second Guildhall School Conference on Diet, Cookery, and Hygiene* (London: National Food Reform Association, 1913), 7.

addressed regarding children's health in schools, medical inspections also became an important aspect of the curriculum.

One example of the importance of medical inspections was *Medical Inspections of Schools in Great Britain* by E.L. Roberts in 1916. These medical inspections were made to ensure that schools were taking the right steps to guarantee the health of their students. One aspect Roberts examined was the work of the children and how this could affect their well-being. He also studied the cleanliness of the schools, making sure that they were a safe environment for children. One of the most important aspects of his work was his examination of the food being served to children and the medical treatment that was provided. This included serving a nutritious meal for children that would help improve their diet and ensuring that those who attend to the medical needs of children at the school were trained and could identify illness and provide medical examinations.¹⁰⁷

Conclusion

During the turn of the twentieth century in Great Britain, advancements in medicine led to greater understandings in children's health. Through the establishment of children's hospitals, researchers developed a place in which the focus on children's health could be cultivated. As a result, many childhood diseases, including rickets, were examined in greater detail in the hopes of better understanding their causation and the treatments that would be most successful in eradicating the disease. While germ theory put some researchers off on the wrong track, clinical observation by researchers such as

¹⁰⁷ E.L. Roberts, *Medical Inspection of Schools in Great Britain* (Washington D.C.: Washington Government Printing Office, 1917), 23 & 42.

Hillier pointed to diet and environment. New modes of experimentation led scientists in Great Britain to discover much about rickets, one of the most prominent childhood diseases of this time. The different issues faced by Great Britain, as seen in this chapter, such as population anxieties, a rising concern over children's health, industrialization, and poverty helped frame the way physicians and researchers addressed rickets and helped them narrow down diet and environment as what they believed were the primary causal factors of rickets. By examining the effects of poverty (malnourishment, poor diet), environment (poor and unsanitary living conditions, cramped spaces with poor ventilation) and industrialization (London smog), physicians and researchers were able to frame rickets as a disease of primarily the lower class.

Chapter Three

Rickets in France: Heredity, Degeneration, and the Clinical Approach

While both Great Britain and France were facing similar issues in regards to population anxieties and children's health, other societal issues helped physicians and researchers in these countries frame their different approaches regarding rickets. In both countries physician and researchers held a multi-causal view of rickets, which involved diet and environment, and in France a strong emphasis on heredity. In Great Britain, industrialization helped frame the way researchers approached the disease, while in France a medical and societal concern regarding heredity and degeneration led researchers to use these factors as the focus of their clinical observations. Whereas some physicians and researchers in Great Britain focused on experimentation, as well as clinical observation, in France, the clinic was almost completely dominant, and physicians instead focused on clinical observations as their primary research method for examining rickets. This chapter will examine the different factors that helped frame rickets, and the methods used by physicians and researchers in their diagnosis, examination and treatment of the disease.

Hospital Medicine, Pediatrics, and the Clinic in France

During the late nineteenth and early twentieth centuries clinical medicine became more important in the diagnosis and treatment of diseases, and the hospital was an important part of clinical medicine, especially in pediatrics. As will be discussed below, the clinic and clinical medicine itself is a structure or a discipline which defines accepted practices and the relations between doctor and patient in the doctor's attempt to

distinguish diseased bodies from healthy ones, and establish the authority with which the doctor will communicate this to the patient.¹⁰⁸

From the French Revolution until the late nineteenth and early twentieth centuries, it is important to know how medicine was shaped in France, and how this rise in clinical medicine took place. Historians such as George Weisz, Michel Foucault, Erwin H. Ackerknecht, John E. Lesch, Ann La Berge and Caroline Hannaway have all written on the changes in French medicine and how this eventually influenced clinical medicine. At the time of the French Revolution, Paris hospital physicians developed observational principles that came to be known as clinical medicine. The origins of this clinical medicine can be traced to Philippe Pinel (1745-1826), Jean Nicolas Corvisart (1755-1821), Xavier Bichat (1771-1802), Rene Theophile Laennec (1781-1826), and Francois Broussais (1772-1838).¹⁰⁹

“The Politics of Medical Professionalization in France 1845-1848” by George Weisz, and “The Politics of Professional Monopoly in Nineteenth Century Medicine: The French Model and Its Rivals” by Matthew Ramsey address the changes that took place in medicine after the French Revolution. Before the French Revolution, licensing of medical doctors was an elitist practice, available to very few. Ramsey shows that during the Revolution this began to change and France “legally abolished preexisting professional

¹⁰⁸ Michel Foucault, *The Birth of the Clinic: An Archaeology of Medical Perception* (New York: Vintage Books, 1973), xv.

¹⁰⁹ Caroline Hannaway and Ann La Berge, *Constructing Paris Medicine* (Atlanta: Editions Rodopi B. V. Amsterdam, 1998), 4.

privileges in medicine”.¹¹⁰ Immediately following the Revolution an anti-elitist movement arose in the practice of medicine, and training as a *docteur en medecin* became open to the middle class. As Weisz points out “the Revolutionary government in 1792-93...destroyed a complex medical system that had been characterized by division, rivalry, and defense of privileges”.¹¹¹ The establishment of the *école de santé* in 1795 emphasized the training of medical professionals through hands-on learning.¹¹² Another change occurred in medicine in France, which moved the responsibility of medical education to the state, when “the Napoleonic bureaucracy promoted a uniform system of state control which granted licenses to individuals, rather than privileges to exclusive bodies”.¹¹³ This ensured that there were licensed medical professionals that could be distinguished from the irregular healers. Not only did the Revolution change the professional practice of medicine, it changed what was available to the patient. As Dora Weiner shows in *The Citizen-Patient in Revolutionary and Imperial France*, “the Revolutionaries reorganized, modernized, multiplied, and varied the institutions where the citizen found health care”.¹¹⁴ Through these changes in regulation, in addition to the development and expansion of the hospital itself as the space in which the newly regulated practice would take place, French medicine had been transformed, allowing doctors more authority and access to patients through the hospitals.

¹¹⁰ Matthew Ramsey, “The Politics of Professional Monopoly in Nineteenth-Century Medicine: The French Model and Its Rivals” in *Professions and the French State, 1700-1900*, ed. Gerald L. Geison (Philadelphia: University of Pennsylvania Press, 1984), 228.

¹¹¹ George Weisz, “The Politics of Medical Professionalization in France 1845-1848” in the *Journal of Social History* 12 (Fall 1978), 4.

¹¹² Porter, *Greatest Benefit*, 352.

¹¹³ Ramsey, *The French Model*, 236.

¹¹⁴ Dora Weiner, *The Citizen-Patient in Revolutionary and Imperial Paris* (Baltimore: The Johns Hopkins University Press, 1993), 10.

As discussed in Chapter Two, hospitals played a crucial role in medicine in both Great Britain and France in the nineteenth century. As shown by Foucault, the hospital is “a structure that is essential to the scientific coherence and also to the social utility and political purity” of medicine.¹¹⁵ While hospitals such as the Hotel-Dieu in Paris, which had existed since at least 829, it was not until the 1700’s that the role of the hospital began to change.¹¹⁶ As shown by Weiner, starting around 1775 a new hospital emerged. Before this time, hospitals had acted as a place of shelter, where a person could receive advice and also receive a physician’s care if needed.¹¹⁷ Weiner states, “the new hospital aimed at the patient’s recovery rather than their salvation, and hospitalization sometimes even included a week’s stay in a convalescents’ section with permission to go out and find work”.¹¹⁸ The rise of clinical medicine yet again changed the role of the hospital. While the hospital became central to clinical medicine as a place where physicians could examine a large number of patients and diseases, Foucault, according to Weiner, believed that through this the physician focused solely on the disease and not the “patient-oriented treatment of the physically and mentally ill nor for any recognition that patients do need guidance and doctors have expertise that enables them to diagnose”.¹¹⁹ This demonstrates not only the changing role of the hospital, but also the changing role of physicians, giving them more authority in patient care and treatment.¹²⁰ Finally, the combination of advances in clinical medicine and the development of the modern hospital

¹¹⁵ Foucault, *Birth of the Clinic*, 70.

¹¹⁶ Erwin H. Ackerknecht, *Medicine at the Paris Hospital: 1794-1848* (Baltimore: The Johns Hopkins University Press, 1967), 19.

¹¹⁷ Weiner, *Citizen-Patient*, 9.

¹¹⁸ Weiner, *Citizen-Patient*, 36.

¹¹⁹ Weiner, *Citizen-Patient*, 15.

¹²⁰ Weiner, *Citizen-Patient*, 174.

provided an ideal environment for the emerging new specialty of pediatrics, as well as pediatric hospitals.

In the Paris hospitals, thanks to the development of medical specialties in addition to advancements in technology and research methods, pediatrics became a distinct branch of medicine. This development is discussed by Erwin H. Ackerknecht in *A Short History of Medicine*. Through the development of medical specialties, as Ackerknecht demonstrated was necessary in the growing field of medicine, the new specialty of pediatrics made the study of rickets in children possible. Ackerknecht shows that specializations arose due to new interests in subdividing medicine in regards to instruments, diseases, age groups and organs. He states, “the great increase in scientific knowledge during the nineteenth century for the first time made it possible, and even necessary, for medical men to limit their practice to the diseases of certain organs or organ groups”.¹²¹ By dividing into specialties, children were finally able to get the separate medical attention they needed. Pediatrics became an important specialization in the medical community due to this development. Supported by ideas from Enlightenment thinkers such as Rousseau, who believed that it was important to raise a healthy child, pediatrics was able to focus on children and their diseases specifically, something that had not really been done before.

In France, the first hospital for children, the Hospitals des Enfants Malades, opened in 1802. This was not only a first for France, but it was also the first children’s hospital in the world. The hospital was very successful, and was able to treat many

¹²¹ Erwin H. Ackerknecht, *A Short History of Medicine* (Baltimore: The Johns Hopkins University Press, 1982), 194.

patients. It began with 300 beds for patients and then soon expanded to include 600 beds.¹²² With the rise of the specialization of pediatrics, as well as children's hospitals where this could be practiced, children's health was able to become a focus not only in regards to population, but also in regards to disease and health.

The development of the modern hospital and specialties made way for the rise of clinical medicine. As demonstrated by La Berge and Hannaway, "the more theoretical training that had supposedly dominated Old Regime faculties was to be replaced by the clinical training in hospitals".¹²³ This shift to clinical medicine and its importance is one that is covered in great detail by Michel Foucault in *The Birth of the Clinic*. Foucault examines what changed and why with the rise of clinical medicine. Foucault's work has been one of the most important in the field of medical history in regards to the development of clinical medicine.

Foucault argues that modern medicine formed in the late eighteenth century. Physicians began to examine disease and patients in a new way. The dialogue between the physician and the patient began to change. While before the physician would ask the patient "what is the matter with you?" with the rise of the clinic, physicians began to question "where does it hurt?".¹²⁴ Before clinical medicine, physicians focused on the symptoms that the patients described, while with clinical medicine, physicians used the symptoms presented by the body to discover the disease that was affecting the patient. Foucault shows that this demonstrates a shift from the focus on the invisible to the

¹²² Ackerknecht, *Paris Hospital*, 173.

¹²³ La Berge and Hannaway, *Paris Medicine*, 1.

¹²⁴ Foucault, *The Birth of the Clinic*, xviii.

visible.¹²⁵ As shown by Ackerknecht, this was done through an active examination of the patient. Through this active examination the physician focused on the symptoms or lesions that he could see, the problems he could hear (through the use of the stethoscope), and the problems that he could physically feel with his hands.¹²⁶ This focus on the disease and body itself became an important aspect of the clinic, with Foucault believing that the new “medical gaze” focused medicine primarily on the body of the patient and not the patient herself/himself as a complex individual.¹²⁷ While the “medical gaze” may have made clinical medicine effective, allowing doctors to focus their attention on the parts of the body in which they specialized, Foucault argues that it made the doctors less concerned with the whole patient, including their perceptions of pain and suffering and the otherwise individuality of the patient.

Foucault also discusses how autopsies figured in the new clinical medicine. Although autopsies had been performed long before the rise of clinical medicine, it was during this time that they became an important tool for physicians examining certain diseases. He shows that pathological anatomy became an important part of this, because through “opening up corpses” physicians were able to understand what effect the diseases had on the organs of the body.¹²⁸ Through pathological anatomy and autopsies, physicians were able to see the changes in the organs and tissues that took place as a result of a disease; he states, “all inflammations of serous membranes can be recognized by their thickening, the disappearance of their transparency, their whitish colour, their

¹²⁵ Foucault, *The Birth of the Clinic*, 159.

¹²⁶ Ackerknecht, *History of Medicine*, 146.

¹²⁷ Foucault, *The Birth of the Clinic*, xiv.

¹²⁸ As discussed in Foucault, “pathological anatomy is a science whose aim is the knowledge of the visible alterations produced on the organs of the human body by the state of disease”, 135.

granulous alterations, and their adhesion to adjacent tissues”.¹²⁹ Foucault demonstrates that through the use of autopsies, the medical gaze was expanded to focus on not just the living body but also the dead.¹³⁰ The autopsy was important to clinical medicine because it allowed physicians to see the effect of the disease on a deceased body, and this will be seen in Rene Racadot’s examination of rickets below, which discusses autopsies on patients with rickets. Also, it was important both for diagnosis and as a research tool. Using the findings from the autopsies and pathological anatomy, physicians were then able to use this knowledge in their observations of living patients in the hospital. Foucault shows that this change was possible with the reorganization of the hospital, and the use of the “medical gaze”, which focused on the body and disease.¹³¹ Through this Foucault demonstrates, what was once invisible became visible, and the basis for modern medicine was formed.¹³²

Even more so than Foucault, Ackerknecht emphasized the empirical characteristics of the clinical approach. However unlike Foucault, Ackerknecht presents this as a straightforward and valuable advancement in medical understanding; to him medicine should rely heavily on observation. La Berge and Hannaway point out that “Ackerknecht admired the Paris clinicians’ advocacy of the importance of sense impressions and direct experience in the acquisition of medical knowledge. He believed this gave medicine a concreteness and a freedom from abstraction that has subsequently

¹²⁹ Foucault, *The Birth of the Clinic*, 129.

¹³⁰ Foucault, *The Birth of the Clinic*, 146.

¹³¹ Foucault, *The Birth of the Clinic*, 196.

¹³² Foucault, *The Birth of the Clinic*, xii.

been lost”.¹³³ Foucault on the other hand was less concerned about the practice of medicine and more concerned about what the creation of medical knowledge implied about diseases, patients, physicians, and their societies. While Ackerknecht put his full faith and confidence in observation and empiricism, Foucault believed there was far more involved in clinical medicine which he viewed as a social practice, involving far more than physicians treating patients. As La Berge and Hannaway point out, Foucault “is not interested in investigating the causes of medical change. He is intent on capturing a changed perception of humans and disease”.¹³⁴ This perception involved what Foucault would refer to as production of knowledge in the medical sciences which affected the web of physicians, hospitals, patients, and diseases, as well as the science of medicine itself.

Dora Weiner also discusses clinical medicine in *The Citizen-Patient*. In regards to Foucault’s belief that physicians came to focus on the disease, while ignoring the actual patient, Weiner shows that through her research she does not believe this to be completely true. Weiner shows that the hospital and clinical observation played a vital role in medicine since the French Revolution, however, she believes that the patient was not completely forgotten through this process as Foucault suggests. She states, “Foucault’s views, when checked against archival sources and printed evidence, prove partial in both senses of the term – they are incomplete and they are biased”.¹³⁵ Other historians focus more on the success of Paris clinical medicine and its attempt to understand the patient and the disease.

¹³³ La Berge and Hannaway, *Paris Medicine*, 36.

¹³⁴ La Berge and Hannaway, *Paris Medicine*, 34.

¹³⁵ Weiner, *Citizen-Patient*, 15.

Ann La Berge and Caroline Hannaway in their introduction in *Constructing Paris Medicine* showed that there were five aspects of clinical medicine in France that made it so successful and influential to other medical communities world-wide. Many of these aspects are discussed by other historians such as Foucault and Ackerknecht, however, La Berge and Hannaway clearly show the effect these five factors had and why they were important to the rise and spread of clinical medicine. The first was the rise of pathological anatomy, which drew attention to the distinction between clinical examination and autopsy. As shown above by Foucault, changes in the patient as well as those observed during autopsies of patients suffering from the same disease, helped physicians draw a correlation between the disease seen in the clinical examination and the disease seen in the autopsy. This helped physicians to diagnose each patient depending on the symptoms that they presented.¹³⁶ The second aspect that made French clinical medicine so successful was how widespread it became, as the state began to take over hospitals from religious, charity based and other private interests.¹³⁷ This allowed physicians to practice on thousands of patients, which helped them gain more knowledge through the cases they observed.

The third aspect that made it successful was one of the most important according to Foucault. While before physicians had talked and listened to the patients' problems, they now did a physical examination of the patient to focus on empirically evident symptoms. La Berge and Hannaway demonstrate that this change in medical examination and the development of clinical examination could not have been

¹³⁶La Berge and Hannaway, *Paris Medicine*, 4.

¹³⁷Weiner, *Citizen-Patient*, 313.

accomplished without the use of the stethoscope (which made the physical examination more thorough and more accurate), the hospital itself (where the practice of large-scale medicine would take place), and the use of medical statistics in case studies.¹³⁸ It was these developments in clinical medicine that made it so successful and earned it widespread recognition.

Experimental medicine also rose in prominence in the nineteenth century, expanding and revitalizing clinical medicine in the late nineteenth century. In France, the most important man in this field was a physiologist named Claude Bernard (1813-1878). Bernard's emphasis on experimental medicine (mainly on canines) helped physicians gain insight as to the basic physiological process of the body in a normal and deceased state. Most of Bernard's essential experimental work took place from 1841-1853. This work consisted of experiments regarding "the glycogenic function of the liver, the role of the pancreas in the digestion of fats, and the existence of the vasomotor nerves".¹³⁹ As Lesch shows, Bernard "saw a positive role for clinical and pathological experience when critically weighed in conjunction with experimental investigation".¹⁴⁰ Although he thought the two could be used in conjunction with one another, he also thought that clinical medicine had its restrictions that could be remedied by experimental medicine. Bernard believed that clinical medicine was "passive, observational, and empiricist, tending to acquiesce in the notion of the inherent spontaneity of the phenomena of life

¹³⁸ La Berge and Hannaway, *Paris Medicine*, 4.

¹³⁹ John E. Lesch, *Science and Medicine in France: The Emergence of Experimental Physiology, 1790-1855*. (Cambridge: Harvard University Press, 1984), 198.

¹⁴⁰ Lesch, *Science and Medicine*, 199.

and the limitations it placed on the scientific investigation of the organism”.¹⁴¹ It was due to this limitation that Bernard believed experimentation was necessary, so physicians could create a controlled environment in which they could study these diseases. Lesch shows that a relationship between clinical medicine and experimental medicine grew from these ideas, and “from clinical experience came suggestions of physiological problems to be investigated, field of observation that complimented animal experiment, and the routine of autopsy associated with pathological anatomy”.¹⁴² Due to this relationship, experimental medicine was a very important factor in the discovery of the causation of rickets and its treatment. Ironically this work was carried out not in France, but in Great Britain.

Like in Great Britain, bacteriology had a tremendous impact on French medicine in the 1880’s and afterward. Theories about contagion that passed from miasma and germ theory can be seen in some of the primary sources examined later in this chapter. As demonstrated by Ackerknecht, “a definite answer could finally be given to the question as to whether the disease –producing agent was a ‘miasma’, a chemical agent, or a living organism”.¹⁴³ However, this thought did not apply to all diseases; the task now was for researchers to distinguish infectious disease, from diseases of other origins such as environment and diet. This was one of the problems faced by physicians and researchers examining cases of rickets. While some physicians wanted to believe that

¹⁴¹ Lesch, *Science and Medicine*, 199.

¹⁴² Lesch, *Science and Medicine*, 6.

¹⁴³ Ackerknecht, *History of Medicine*, 183.

bacteria could be a cause of the disease, others believed additional factors were to blame.¹⁴⁴

As shown by Alisa Klaus in *Every Child a Lion*, bacteriology and the laboratory also influenced the discourse on breast-milk. Like Great Britain, one of the main concerns involving children's health and ways that mothers could be involved in promoting infant health was through an emphasis on breast-feeding. French mothers were not only encouraged to breast-feed through mother's manuals, but also through the creation of crèches and the development of clean milk stations, as discussed in Chapter One. Since one factor in the cause of rickets was believed to be a faulty diet due to being weaned too early or to faulty breast-milk, the issue of physicians' concern over breast-feeding was very important.¹⁴⁵

Laboratory medicine played a major role in the discourse on breast-feeding and its influence on pediatric diseases in France. This allowed the chemical analysis of both mother's milk and cow's milk and how this composition affected the health of the child. Through this analysis it was determined that mother's milk was better for the infant, unless the mother was suffering from a disease or complication that made her milk watery, less nutritious, and faulty in the eyes of the physicians.¹⁴⁶ It was then that physicians would suggest either a wet-nurse or cow's milk, as long as it was from a sanitary milk station. This concern with breast-feeding, which was seen in many countries such as Germany, Great Britain, France, and the United States, was an

¹⁴⁴ Ackerknecht, *History of Medicine*, 183.

¹⁴⁵ Klaus, *Every Child A Lion*, 48.

¹⁴⁶ Ackerknecht, *History of Medicine*, 201.

important aspect of French medicine concerning rickets, as seen through the medical texts from the time. As can be seen in many of the primary sources, one of the questions asked by physicians during a clinical examination was if the child had been breastfed and if so for how long.

Medical Perspectives on Rickets in France: 1860's – 1930's

As discussed above, physicians and researchers in Great Britain and France took a multi-causal view regarding the etiology of rickets. However, French researchers, through clinical observation, even more so than those in Great Britain, took a more multi-causal approach, which in some explanatory models included a central role for heredity. Heredity was a very important factor in French medicine during this time, as shown by Schneider in *Quality and Quantity*. Schneider demonstrates that “by the end of the nineteenth century, intellectuals as well as the general public attached a great deal of importance to hereditarian ideas”.¹⁴⁷ As will be shown through the French researchers from the 1860's to the 1930's, the idea of heredity was one that had a lasting effect on medicine, and in this study, rickets. While many physicians throughout this time believed heredity to be a cause of rickets, not all rickets cases supported this theory. As will be seen below, one French researcher who struggled with heredity as a causal-factor was T. Chonnaux-Dubisson. It was due to this that physicians and researchers had to find different causal factors to explain why rickets had developed in a child. Through the physicians and researchers seen here, a picture of the importance of heredity as a causal factor in rickets is seen, as well as other causal factors that were discussed when heredity

¹⁴⁷ Schneider, *Quality and Quantity*, 70.

was not an option. There are two important points to be made regarding these French sources compared to those of the British discussed in Chapter Two. One was that while physicians and researchers in Great Britain began to reject the theory of heredity early on, for French researchers it was a factor that they could not give up in regards to the etiology of rickets, as well as other diseases during this time. The second point is that due to this inability to disregard heredity as a causal factor, the French sources below do not show as much change over time as British physicians and researchers, which demonstrates why the British, through clinical observations and experiments, were able to distinguish the correct causal factors of the disease.

Armand Trousseau (1801-1867), a physician-in-chief at the Hotel-Dieu and professor of clinical medicine in the Faculty of Medicine in Paris, spent years examining and treating children with rickets.¹⁴⁸ In his observations on the cases that he examined, and the conclusions that he drew about the disease, its etiology and treatment (which emphasized that most French physicians and researchers were focused on heredity as the main causal factor of rickets), Trousseau recognized that there was more to the causation of rickets than just heredity (such as climate and diet), although he still believed it was a primary causal factor. His ideas expressed in his *Lectures on Clinical Medicine* (1868) (published posthumously) “was largely forgotten by 1900”.¹⁴⁹ Trousseau’s work is important for two reasons, one is that it clearly demonstrates some of the commonalities and differences between French thoughts and British thoughts on rickets, and the second

¹⁴⁸ Peter M. Dunn, “Armand Trousseau (1801-67) and the Treatment of Rickets” in *Arch Dis Child Neonatal Ed* 1999, 155. Dunn’s short article provides basic information about Armand Trousseau, and shows that Trousseau’s work was very important but that it was largely forgotten.

¹⁴⁹ Dunn, *Trousseau*, 156.

is that it demonstrates the overwhelming influence of clinical observation and its observational methods on Trousseau's work in the hospital.

Trousseau begins his study on rickets with a discussion of the history of the disease, unlike British physicians who paid no attention to such matters. Through the French medical texts provided this was a very common occurrence. French physicians believed that it was important to understand the history of the disease and how knowledge of it had changed in order to more accurately discuss their observations on the disease. French researchers also give much greater effort to describe relevant scholarship of the preceding generation of experts, as well as the long history of disease.¹⁵⁰ For example, Trousseau begins with Ancient Greece and describes previous ideas about rickets. This historical analysis of the disease is not one seen in the British primary sources.

Like many French physicians at the time, Trousseau thought that one important component of rickets could be hereditary in some cases. He stated that, "no one disputes the part which hereditary predisposition plays in the etiology of rickets".¹⁵¹ This idea of "hereditary predisposition" is discussed by Schneider in the secondary literature, who shows that it refers to the "hereditary transmission of negative characteristics acquired from parents in certain pathological states" (which could include diseases such as syphilis and alcoholism, as well as what he called "physical and moral depression").¹⁵² While Trousseau was confident in the heredity theory, he points out that not all cases followed

¹⁵⁰ Danielle Gourevitch, "Charles Daremberg, His Friend Emile Littre, and Positivist Medical History" in *Locating Medical History: Their Stories and Their Meanings* ed. Frank Huisman and John Harley Warner (Baltimore: The Johns Hopkins University Press, 2004), 52.

¹⁵¹ Armand Trousseau, *Lectures on Clinical Medicine*. (Paris: J.-B. Baillire 1868), 81.

¹⁵² Schneider, *Quality and Quantity*, 73-74.

this rule. Trousseau thought that rickets did not always develop in children whose parents were rachitic, but that they were more liable to develop the disease. He thought that although there was a hereditary factor in rickets, this factor was much more pronounced in osteomalacia. Trousseau's thoughts on this led him to observe that osteomalacia was really just rickets for adults.¹⁵³ This was an important observation because it led to ideas on treatments that could be applied to both diseases.¹⁵⁴

Trousseau, demonstrating the multi-causal approach, believed that he could prove that climate and class had a definite effect on the incidence of rickets, in the cases that could not be explained through heredity. This was a very early observation about the relation of climate to rickets. As we saw in the previous chapter, while Palm made these observations in 1891, Trousseau's work was published in 1868. Trousseau stated that, "climate has an undoubted influence upon the development of rickets. The disease is unquestionably much more common in damp cold countries than elsewhere".¹⁵⁵ Through this observation, Trousseau noted that rickets was more likely to develop in countries such as England and France because of their cold, damp climates. He also noted that these conditions did not just encourage rickets in children, but also caused rickets to develop in animals in these climates as well. Trousseau's thoughts on climate and rickets were important, though largely disregarded, because they made a connection between how climate and poverty could affect a disease.¹⁵⁶

¹⁵³ As shown in *Vitamin Discoveries and Disasters*, Trousseau was one of the earliest physicians to make this claim, 97.

¹⁵⁴ Frankenberg, *Vitamin Discoveries*, 98.

¹⁵⁵ Trousseau, *Clinical Medicine*, 79.

¹⁵⁶ Trousseau, *Clinical Medicine*, 79.

Moreover, Trousseau stated that rickets was also more likely to be found among the poor. As shown in *Death is a Social Disease* by William Coleman and *Childhood in Nineteenth Century France* by Colin Heywood, diseases such as rickets were more likely to be found among the poor and the mortality rate from these diseases was higher among the poor. Coleman shows that in nineteenth century France, “wealth tended to reduce the number of births, increase abandonment of natural children, and preserve life; the poor, by contrast, tended to reproduce more abundantly, lose more children to death, recognize their natural children, and themselves die younger”.¹⁵⁷ There were many factors that contributed to the poor contracting and dying from diseases. These factors could include water, housing (including poor living conditions due either to sanitation, overcrowding, or both), and diet deficiencies. As shown by Heywood, “it is particularly in the working class, where the children are abandoned, deprived of maternal care, denied the necessary cleanliness, and surrounded by poor hygienic conditions, that they are consumed by scrofula, rickets and various eruptive diseases”.¹⁵⁸ These factors discussed by Coleman and Heywood are part of the multi-causal theory as illustrated by physicians such as Trousseau. Trousseau demonstrates that in some case studies heredity was not a factor, rather rickets developed because poor children were weaned earlier, or because of the unhealthy environment they grew up in.

Trousseau also believed that insufficient nourishment could be an essential cause. Like most physicians during this time Trousseau believed that children who were weaned too early were more likely to develop rickets. While some physicians believed that a

¹⁵⁷ William Coleman, *Death is a Social Disease: Public Health and Political Economy in Early Industrial France* (Madison: University of Wisconsin Press, 1982), 163.

¹⁵⁸ Heywood, *Childhood*, 168.

child needed to be breast-fed for a certain length of time, Trousseau believed that weaning a child depended on other factors. He believed that if a child was weaned before its teeth began to come in it had a higher chance of developing rickets. Although insufficient breast-feeding or breast-milk was a common belief during the 1860's by physicians in both Great Britain and France, it is still important to note that Trousseau was on the right track in believing that diet played a key role in the development of rickets in France.¹⁵⁹

Trousseau's suggested treatment for rickets was the same as other British and French physicians, cod liver oil. Although physicians knew that this treatment worked, they were not positive why. Trousseau's work provides a history of how this treatment came into use in France. He explained that cod liver oil made its first appearance in treating rickets in France in 1827, through the famous physician Pierre Bretonneau (1778-1862). Bretonneau had treated a child who had rickets who was not responding to any of his medication. Eventually, the father told Bretonneau that his other child had been treated by a doctor in Holland for the same disease and had recovered. The treatment used had been cod liver oil, which proceeded to cure Bretonneau's patient, as well as the other patients for whom he prescribed it. Trousseau was one of the physicians with whom Bretonneau shared this treatment, and from there it became commonplace in the treatment of rickets.

Most physicians during this time were not making the same connections that Trousseau did in regards to rickets and its causal factors. A good example of this is *Du*

¹⁵⁹ Trousseau, *Clinical Medicine*, 81.

Rachitisme (1868), by T. Chonnaux-Dubisson (1831-1906). Chonnaux-Dubisson examined rickets by looking at the multi-causal factors that were present in the different cases he encountered, like Trousseau and others. However, while Trousseau and other French physicians believed heredity played a key role in the development of rickets, through the case studies Chonnaux-Dubisson examined he could not support this conclusion, leading him to be conflicted on the topic. Also, unlike other physicians throughout the time period Chonnaux-Dubisson had some different ideas on causal factors, even believing that clothing could have an effect on the development of rickets. However, as was typical of French physicians, Chonnaux-Dubisson began with a history of the disease which replicated much of what Trousseau also wrote.

Chonnaux-Dubisson studied the age of patients, in order to understand during what period of infancy and childhood rickets was more likely to develop. Through the observations on his cases he noticed that rickets was unlikely to develop in the first six months of a child's life, but the signs of rickets were usually present in a child before the age of four (a presentation of a typical case study by Chonnaux-Dubisson is presented in Chapter Four).¹⁶⁰ Chonnaux-Dubisson looked at the progression of rickets in infancy and childhood, and is a good example of multi-causal understandings typical of the time. Chonnaux-Dubisson's main concern in this work was examining the popular medical beliefs on the causation of rickets and discussing his own observations in regards to these ideas.

¹⁶⁰ T. Chonnaux-Dubisson, *Du Rachitisme*. (Amiens: Au Caron fils, 1868), 28.

Like Trousseau and other French physicians, Chonnaux-Dubisson demonstrated a multi-causal approach in his examination of rickets. In addition to heredity, diet and climate, some physicians implicated factors as diverse as clothing and the measles, in their multi-causal discussion of the disease. Like Trousseau, Chonnaux-Dubisson observed that rickets occurred more often in cold, damp climates. He showed that cities such as London and Paris which had cold climates had a higher number of rickets cases seen than cities such as Buenos Aires and Rome, which had warmer climates. Unlike other researchers (such as Palm and Trousseau), who believed that cold climate could be a factor, Chonnaux-Dubisson believed that the clothing that children wore could encourage rickets in cold climates. He argued (but presents no evidence) that clothing was important in protecting children against rickets, since he believed that if children had warm clothing such as flannel waistcoats, then the cold weather would not have as much effect on a child developing rickets.¹⁶¹ Chonnaux-Dubisson confused the relationship between warm clothing and cold climates for what we now know is the real cause which was a vitamin D deficiency, caused by lack of sunshine.

Like other researchers and physicians, Chonnaux-Dubisson realized that nutrition played a key role in rickets. Here he saw a connection to infectious disease. While he explains that he and his colleagues did not believe that rickets was contagious stating, “La plupart des auteurs dans leurs travaux sur le rachitisme n'abordent pas meme cette question de la nature contagieuse du rachitisme, tant les idées sont éloignées chez nous d'admettre, pour cette maladie, rien qui ressemble à la contagion,” he did believe that other infectious diseases they had developed in childhood may have had an effect on their

¹⁶¹ Chonnaux-Dubisson, *Du Rachitisme*, 35.

diet and health.¹⁶² In many of the cases he had seen, the child had been diagnosed with pneumonia or measles sometime before they had developed rickets. He thought the issue was that the child suffered from a lack of proper nutrition during these diseases due to lack of appetite, which could then continue well after the child had recovered from the disease.¹⁶³ These diseases could affect the health and diet of a child for a long period of time, due to the long periods of convalescence associated with them. Chonnaux-Dubisson believed that it was essential to amend the diet of the child in order for them to recover, in particular through fatty cod liver oil. However, he believed that rickets was completely preventable as long as parent provided their child with healthy housing, and a healthy and sufficient diet.¹⁶⁴

As discussed above, Chonnaux-Dubisson's own cases studies and the work of other well-known physicians left him conflicted in regards to the widespread heredity theory. He noted that of the cases examined by other physicians two-thirds of the cases were believed to be due to hereditary factors.¹⁶⁵ However, Chonnaux-Dubisson's own cases did not stand up to this statistic. Of the sixty-three cases of rickets he had observed, only six cases presented hereditary factors in his view. He stated that rickets had to be hereditary because so many important physicians observed it was, however his own observations left him inconclusive in the matter. He stated that while there were some cases he examined that were irrefutable evidence that rickets was hereditary, many of his other cases did not prove this theory. This was an interesting observation for a French

¹⁶² Chonnaux-Dubisson, *Du Rachitisme*, 30.

¹⁶³ Chonnaux-Dubisson, *Du Rachitisme*, 33.

¹⁶⁴ Chonnaux-Dubisson, *Du Rachitisme*, 105.

¹⁶⁵ Chonnaux-Dubisson, *Du Rachitisme*, 39.

physician during this time. While the British researchers, such as Hillier in the 1860's, had already begun to dismiss heredity as a cause of rickets, researchers in France still held heredity as the dominant causal factor. Chonnaux-Dubisson knew that heredity was the dominant paradigm in regards to rickets; however his own observations did not support this theory. Due to this he had a difficult time making an argument about hereditary rickets, unlike physicians such as Marfan and Trousseau who did not show any doubt when discussing the hereditary factors of rickets.¹⁶⁶

Chonnaux-Dubisson's indecisiveness in regards to hereditary rickets stands out in comparison to other French physicians during this time. One physician who strongly believed in the hereditary factor of rickets was M. Bilhaut. In spite of the doubts regarding heredity from observational studies like Chonnaux-Dubisson, and experimental work being done by British researchers, we find a lasting emphasis on heredity in the French literature demonstrated in the work *Le rachitisme, ses causes, ses effets immediate et eloignes* by M. Bilhaut in 1901. Although this work was published decades after Trousseau and Chonnaux-Dubisson, there is little change in the belief on the causal factors of rickets. Although Chonnaux-Dubisson had found strong reasons to doubt the heredity theory, Bilhaut in the twentieth century believed that heredity was still an important factor in the French explanatory model of rickets, though he does posit other causal factors for the cases that do not demonstrate the hereditary model.

¹⁶⁶ Reed Pyeritz, "Marfan Syndrome" in the *New England Journal of Medicine* (Vol. 323 No. 14 1990), 987. Antoine Bernard-Jean Marfan (1858-1942), the first professor of pediatrics in Paris, a French pediatrician at the University of Paris and a member of the Académie de Médecine, was a strong supporter of the heredity theory in rickets as seen in his work *Le rachitisme et sa pathogénie*. Marfan is best known for his discovery and study of Marfan Syndrome.

Bilhaut, like Trousseau and Chonnaux-Dubisson, showed that rickets was an important topic among pediatric physicians. As typical of French texts, he started with the Greeks citing the example of the Greek Thersites, mentioned in the *Iliad*. Bilhaut, as typical of French texts, rests his work on several case studies, demonstrating the traits he believed typical of rickets (onset in first year of life, concave or deformed chest). The article shows how the short and long-term effects of the disease were clearly understood in France at the turn of the twentieth century.

Like Hillier, Forsyth, Trousseau, and Chonnaux-Dubisson, Bilhaut believed in part that some children developed rickets when they were weaned too early, had been nourished by defective breast-milk, or had been eating a diet that lacked the proper nutrition. If the mother could not provide sufficient breast-milk, Bilhaut believed that it was necessary to find a wet-nurse. However, if a wet-nurse could not be acquired then Bilhaut suggested that the infant be weaned onto cow, goat, or donkey's milk. He also stated that a child should never be weaned onto a diet of porridges or flour foods as this alone would not provide the proper nutrition for the child, and could result in rickets.¹⁶⁷ These were common conceptions during the time in regards to rickets and nutrition.

Some of the ideas presented by Bilhaut regarding rickets are interesting because they fit into the broader discourse on degeneracy, heredity and eugenics in France. As discussed by Robert Nye in "Degeneration, Neurasthenia and the Culture of Sport in Belle Époque France", the problem of degeneracy was the effect the French believed it had on the population. The perceived problem was that the French population at the end

¹⁶⁷ M. Bilhaut, *Le rachitisme, ses causes, ses effets immediate et eloignes* (Annales de chirurgie et d'orthopedie. Sept, 1901) 266.

of the nineteenth century was becoming degenerate, that is weakened and enfeebled by new behaviors. Nye shows that, “just as worrisome to the French was the evidence that certain social and organic pathologies were making enough headway to produce the *qualitative* decline in the population”.¹⁶⁸ As discussed in Chapter One, William Schneider points out that eugenics was a popular movement because many believed that problems in France were being caused by degenerates and that concerns over children’s health and population anxieties were ways of trying to eradicate those problems. As shown by Schneider, “the entire population was constantly threatened by degeneration from all sorts of negative influences which could be passed on to subsequent generations. The most frequently mentioned of the influences were alcoholism, venereal disease, and tuberculosis, but they could also include poor diet and living conditions”.¹⁶⁹ This demonstrates how ideas in medicine, and changes in discourse in relation to rickets, were being influenced by ideas in society. Bilhaut examined the factors of causation that he thought had an effect on the development of rickets. While he believed that rickets was a hereditary disease often a result of parents who had rickets or syphilis at some point in their life, he also believed that alcohol could have an effect on a child developing rickets. He believed that if the parents of the child were alcoholics, there was a high chance that the child would develop rickets, based on the cases that he had seen and the idea of “hereditary predisposition” as mentioned above.

¹⁶⁸ Robert Nye, “Degeneration, Neurasthenia and the Culture of Sport in Belle Époque France” in the *Journal of Contemporary History*, (Vol 17, No.1, Decadence Jan., 1982), 54.

¹⁶⁹ William Schneider, “Toward the Improvement of the Human Race: The History of Eugenics in France”, *Journal of Modern History* (June 1982), 277.

In some cases, another important causal factor of rickets could be the environment that the child lived in. If the child lived in a dark, unclean house, Bilhaut believed that the destructive pathogenic microbes that resided there could cause rickets in a child. Also a child that lived in these conditions did not usually benefit from a sufficient diet, which could also cause rickets. Bilhaut's thoughts on causation show different ideas that were circulating at the time in regards to degeneracy and alcoholism, microbiology and nutrition.

Bilhaut was also concerned with what he believed were the long-term effects of children that developed rickets. Since he observed that through "hereditary predisposition" the children who developed rickets often belonged to those who had rickets when they were children, were often alcoholics, and were now unable to provide a sanitary place for their child to live, Bilhaut was concerned about the future well-being of the children that survived the disease. One aspect of this that he was concerned with was that many of the children that did survive did not recover their physical forms, and were deformed for the rest of their lives making it difficult for them to fit into society. Due to this, many of these people became the degenerates of society. Bilhaut believed that it was important to discover and treat rickets early in a child in order to help prevent this unfortunate aspect of heredity in the future.¹⁷⁰

Rene Racadot's 1919 *Contribution a l'etude des formes graves du rachitisme chez les enfants atteints de syphilis hereditaire*, also illustrates how the discourse involving heredity continued into the twentieth century. Like Bilhaut, Racadot began by examining cases of rickets throughout history. The cases he examined included those mentioned by

¹⁷⁰ Bilhaut, *Le rachitisme*, 274.

famous figures throughout history such as Hippocrates and Christopher Columbus, as he wished to demonstrate how long rickets had been a human disease, and how widespread it was. Racadot also examined the different theories that existed on rickets such as how it developed and how it could be treated beginning from 1861 until the early 1900s.

Although the other physicians such as Trousseau, Bilhaut, and Marfan had all thought it was important to understand how rickets was viewed throughout history, it is interesting to note that as late as 1919 this was still seen as an important aspect of any discussion on rickets.

Racadot demonstrated that clinical study was central to the discussion of rickets. He not only demonstrated that physicians had come to realize that rickets was not a disease that was caused by bacteria because upon post-mortem examination of children with rickets no pathogenic causes could be found. Physicians like S. Mircoli had tested for microorganisms such as staphylococcus and streptococcus with negative results. Racadot emphasized how important autopsy was to the study of rickets, but in the French tradition he stressed co-relation and post-mortem findings to the case study.

Racadot's 1919 publications shows an ongoing dialogue among French physicians in regards to hereditary rickets, long after the matter was mostly settled among the British profession. Major figures and medical men recognized as authorities in pediatrics, in the study of rickets such as Trousseau, and Marfan insisted that the disease was hereditary. Although physicians in Great Britain, Germany, and the United States by 1919 were focusing on the therapeutic effect of UV rays and issues of diet, physicians in France were still preoccupied by heredity. Racadot studied under Hutinel (also a

prestigious name in pediatrics and Therapeutics) and Marfan who firmly supported the idea of hereditary rickets, so his thoughts regarding rickets being hereditary are not surprising.

It was not until the late 1920's that views on heredity seemed to change in France. Edmond Lesné's *Le Rachitisme et La Tétanie* (1932) shows how work in Great Britain had come to influence French thought. Lesné could not entirely dismiss the idea of heredity, but he argued that hereditary rickets was a very rare condition and not as dominant as many earlier physicians claimed it to be, however he did believe that it existed. He stated that , “le rachitisme congénital a été très discuté et de nombreux auteurs en ont meme contesté l'existence. C'est à la vérité, une forme très rare mais incontestable. Hutinel, Marfan, Veron, Bouret, Breton en ont rapporté d'indiscutables observations”.¹⁷¹ Lesné, like Chonnaux-Dubisson, mentioned that he had not encountered many cases of hereditary rickets, but stated that since Marfan's work was so important to the study of rickets, his observations had to be accurate. However, Lesné went on to state that new research had proved that other causative factors were far more important and common.¹⁷²

Lesné also discussed the work of Palm and Raczynski and their observations about rickets and the sun. Lesné thought that these observations were correct and used this information to treat his patients. He also discussed Mellanby's work on puppies in Great Britain, and described the work of Elmer McCollum in the United States and his

¹⁷¹ Edmond Lesné, *Le rachitisme et la tetanie* (Paris: Cie, Editeurs, 1932), 33.

¹⁷² Lesné, *Le Rachitisme*, 34.

discovery of Vitamin D in 1922.¹⁷³ Writing during the 1930's, Lesné's work was important because it demonstrated how observations and discoveries concerning rickets were being spread around the world. However, Lesné's respect for these new discoveries did not lead him to dispense entirely with the French tradition of hereditary theory in rickets. Lesné writing in the 1930's shows how researchers moved from focusing solely on historical theories such as heredity, and moved to including contemporary ideas into their new discoveries and methods, effectively internationalizing medical science.

Experimentation in France

While experimentation played an important part in the discourse on rickets in Great Britain, the same could not be said for French pediatrics. While Claude Bernard had played such a significant role in the advancement of experimentation, rickets researchers in France remained more concerned with examining their case studies to determine if their patients had developed hereditary rickets. Although some experimental work was done in France in regards to rickets, notably by Jan Raczynski, the observations made through these experiments mainly confirmed what had already been discovered by other researchers and scientists. While researchers in Great Britain had to conduct their experiments under strict regulations due to a strong anti-vivisection campaign, researchers in France did not have this problem.¹⁷⁴ Despite this however, French researchers were not as focused on determining the causation of rickets through experimentation.

¹⁷³ Frankenberg, *Vitamin Discoveries*, 104.

¹⁷⁴ Ackerknecht, *History of Medicine*, 157.

Jan Raczynski was a French researcher who discerned a pattern with his rickets patients. He noticed that more children were struck with the disease in the winter months from January to May, when the climate was the coldest. In 1912, following the British researcher John Bland-Sutton's work involving rickets in lion cubs in 1889, Raczynski decided to test his theory out with puppies, seeing if the puppies exposed to sunlight were affected by rickets. Kenneth Kiple shows that Raczynski tried, "exposing rachitic dogs alternately to sunlight and darkness and demonstrating that the sunlight measurably increased their bone mineralization".¹⁷⁵ Although this was an important observation, many researchers before Raczynski had already realized that rickets could be seasonal and that the lack of sunlight was one factor in the development of rickets. His realization that sunlight increased the bone mineralization was important; however this would be overshadowed six years later by Kurt Huldshinsky's experimentation with mercury vapor lamps in treating rickets.¹⁷⁶

Conclusion

In France, rickets was framed by factors such as heredity, population anxieties, concern over children's health, and the clinical approach. Heredity was an influential social and medical concern around the turn of the twentieth century, and this helped determine the way that physicians viewed the causation of rickets, through which, heredity became their primary concern. This was addressed through clinical observation, and these case studies provide insight into the diagnosis and therapeutics of rickets in France.

¹⁷⁵ Kiple, *Human Disease*, 134.

¹⁷⁶ Frankenberg, *Vitamin Discoveries*, 100.

Not everyone was fully convinced that heredity played a crucial role in the causation of rickets. Chonnaux-Dubisson, in the 1860's, agreed that the heredity theory was an important factor in the causation of rickets, however he could not support this with evidence from his own case studies. Trousseau, in the 1860's believed in heredity, but in some case studies acknowledged the importance of social and physical environments. Decades later in the early 1900's, Bilhaut also believed strongly in heredity but emphasized that inherited causal factors included things related to degeneration and in some case studies these factors were social or environmental (poor diet, hygiene, living conditions). The influence of the heredity theory lasted into the twentieth century, with Racadot showing that although researchers and physicians knew that bacteria did not play a role in the causation of rickets, the issue of heredity was one that was still in play. Although by the 1930's the heredity theory had not completely been dispensed with, Lesné shows that by this time views on heredity began to change, and shows that heredity was no longer believed to be the primary causal factor in rickets by French physicians. However, while the issue of heredity was predominant in France up until the 1930's, British researchers were quick to dismiss this theory early on and instead focused on causal factors such as environment and diet through the use of experimentation on animals.

Children's health was an important field in the late nineteenth and early twentieth centuries due to anxieties brought on by a declining birth rate and a rising infant mortality rate. Through this concern, physicians began to focus on the diseases of children in order to help address the rising infant mortality rate. In France, with the rise of clinical

medicine in the late nineteenth century, it was possible for physicians to examine rickets and how it affected the living patient. This influence soon spread, and can be seen in how both French and British physicians observed the patient and the disease. Even though Claude Bernard was the most important figure in the history of medical experimentation, French physicians were more concerned with the belief that rickets was hereditary, so there are few cases of experimentation compared to Great Britain, Germany or the United States. Despite this, one researcher, Jan Raczynski, managed to provide some insight into the effect of sunlight on rickets, showing that while clinical studies were the primary concern of French physicians studying rickets, some experimentation was still necessary.

Another important aspect of these medical texts is that they show how cross-cultural influence existed in regards to rickets however this happened very slowly and is not shown until the 1930's as demonstrated by Lesné. Lesné, by discussing the work of fellow researchers on rickets from different countries, as well as Raczynski in France, shows how researchers were using clinical observation and experimentation outside of France, and how French ideas on rickets were eventually influenced by these outside ideas.

Chapter Four

Clinical Observations: Case Studies in Great Britain and France

As the preceding chapters have shown, in France, there was a greater dependency on case studies, while in Great Britain, experimentation was equally important to clinical observation. But in both countries, researchers gained valuable insights from the clinical approach in delineating and diagnosing specific diseases. Using a clinical approach, physicians in Great Britain and France were able to obtain a better understanding of rickets by keeping track of the cases that they examined and comparing them to other patients they believed had the same disease. These case studies are significant because they not only demonstrate some of the ideas regarding rickets during the times they occurred; they also show a change in the understandings of the disease. Using case studies from Great Britain and France, this chapter will demonstrate the techniques used in diagnosing rickets, what symptoms were found in each patient, and how these views differed between the two countries. It will also demonstrate treatments for rickets and their success rate by comparing specific cases described in the literature. This chapter will offer a deeper analysis of four case studies by Hillier, Jenner, and Chonnaux-Dubisson to emphasize the clinical method as well as the multi-causal approach. As discussed in the previous chapters, clinical observation was a crucial form of medicine in the study of rickets, not only in France, but also in Great Britain. This chapter will provide an in-depth analysis of how these case studies were conducted, the examinations of the patients, the symptoms that were present, the role of the physician and how he conducted these observations, and the treatment methods that were used.

Case Studies in Great Britain

In 1868, Dr. Thomas Hillier was a physician at the Hospital for Sick Children in London. He treated young patients diagnosed with rickets, recording many details about the child, his/her symptoms, and the progression of the disease. He hoped to not only gain some insight into rickets, but also to keep an accurate record of how this disease reacted in children over time. Through his work, Hillier came across and wrote about many different cases of rickets during his time at the Hospital for Sick Children. While he was successful in treating some of his patients, many were too ill for the treatment to be successful. By examining one of his case studies, a picture of rickets in the 1860's in Britain emerges, showing how it was diagnosed, its symptoms, its progression, its treatment and if this was successful.

One case study that Hillier briefly discusses in his *Diseases of Children* (1868), was that of a five and a half year old girl named Emily E. Copus. Although most physicians during this time obtained a family history of the child to see if rickets was found in other members of the family, Hillier did not think that was necessary because he did not truly believe that rickets was hereditary.¹⁷⁷

Hillier was very concerned with the symptoms that Emily presented when she first came into his care at the Hospital for Sick Children. Although she was five and a half years old, Emily had never been able to walk and only measured 28 inches in height. A normal healthy three year old, Hillier wrote, usually measured from 33 to 36 inches tall. This demonstrated for him that Emily had developed rickets early on which affected

¹⁷⁷ Hillier, *Diseases of Children*, 88.

her growth and ability to walk. Emily's dentition was also very bad. While she had developed teeth, six of her incisors had fallen out, and many of her remaining teeth were broken and unhealthy.¹⁷⁸

Emily also presented many other signs of rickets that helped Hillier diagnose and treat her condition. Emily had a large, resonant abdomen, which was very common in rachitic children. She also possessed deformed clavicles, humeri, fore-arms, dorsal spine and femora. These deformities are what led to Emily's inability to walk, as well as her small stature. Her lymphatic glands were hard and moveable as well. These symptoms led Hillier to identify that Emily was afflicted with rickets. He then prescribed a treatment to help her recover.¹⁷⁹

Like many physicians during the 1860's Hillier knew that cod liver oil was successful in treating rickets, even if the true reasons for its success were unknown. Due to this knowledge, Dr. Hillier prescribed Emily a diet that consisted of cod liver oil, well-chopped meat, and milk, a common diet for treating rachitic children as we have seen. Hillier explained that rickets was a disease of a faulty diet. Replacing that faulty diet with a diet made up chiefly of cod liver oil would help treat Emily's rickets. During her stay at the hospital, Hillier kept Emily on this diet for over three months, and was successful.¹⁸⁰ After therapy Emily began to grow and was eventually able to walk.¹⁸¹

¹⁷⁸ Hillier, *Diseases of Children*, 88.

¹⁷⁹ Hillier, *Diseases of Children*, 88.

¹⁸⁰ As shown by Dora B. Weiner in *The Citizen-Patient in Revolutionary and Imperial Paris*, children's hospital stays were usually long (p.212). This enabled researchers, such as Hillier, to follow these case studies for long periods of time.

¹⁸¹ Hillier, *Diseases of Children*, 88.

Not all patients were so lucky, for some their rickets had developed past the stage where cod liver oil would not be an effective treatment.

Another British physician, Sir William Jenner, also kept detailed records about the cases of rickets that he encountered in his *Clinical Lectures and Essays on Rickets, Tuberculosis, Abdominal Tumours and Other Subjects* (1895). This included some cases in which he believed that rickets had progressed so far that it was deemed to be untreatable. Jenner was the consulting physician to the University College Hospital, where his case studies took place. Jenner gives a very detailed account of the patient, the family background, the development of the disease, its symptoms, and the treatment prescribed. As shown in the previous chapters, a multi-causal approach was often taken in these case studies. This can be seen in Jenner's case studies by his examination of the family of the patient and the patient's diet. One important case that he examined involved a one-year old named William F.B., who was treated and stayed at the Hospital for Sick Children in 1860¹⁸²

The case of William began with an examination of his family. Although Jenner saw the family to be of "decent" circumstances, he noted that the mother, who had seven children, had syphilis when pregnant with her first child (as shown by Schneider in the previous chapter syphilis was considered a negative hereditary factor, it also prevented the mother from properly breast-feeding due to lesions on the breast, or caused her to produce insufficient breast-milk). Nevertheless, that child never developed any ill effects, even though breast-fed. Jenner also examined the five other living siblings of

¹⁸² William Jenner, *Clinical Lectures and Essays on Rickets, Tuberculosis, Abdominal Turmours and other Subjects* (New York: Macmillan and Co., 1895), 57.

William, he illustrated that although the eldest children never showed any signs of developing rickets, the two youngest including William had developed the disease. Jenner did not believe that rickets was hereditary, but believed that the health of the mother was important because it affected the diet of the children in regards to breast-feeding.¹⁸³

The next issue that Jenner examined was William's diet. Jenner was concerned that his mother had perhaps weaned him too early, creating a lack of proper nutrients, a contributing factor of rickets. However, he learned that William had been "properly breast-fed" for almost a year, and was slowly being weaned from breast-milk to cow's milk and bread when he was brought into Jenner's care at the hospital. Through this, Jenner believed that nutrition could not be the only significant factor in William's development of rickets.¹⁸⁴

After his thorough examination of William's family and diet, Jenner then proceeded to discuss the symptoms that William presented that caused his parents alarm and resulted in William coming into Jenner's care. As William began to age he was never able to walk, or sit up on the floor. He was also very tender to touch, he cried when he was moved, and did not like to be dressed in clothes. One issue that was very prominent in examining William was his large protruding abdomen and the deformity of his chest, all diagnostic of rickets. He also suffered from a "hot head" and profuse sweating, which, Jenner stated, were common concerns of parents in regards to rickets. William further suffered from a large, movable spleen and hard, round, and movable

¹⁸³ Jenner, *Clinical Lectures*, 58.

¹⁸⁴ Jenner, *Clinical Lectures*, 58.

lymphatic glands. His bowel movements were very watery and “relaxed.” He also suffered from very soft bones that were bent in the arms and thighs.¹⁸⁵

Jenner stated that the most troubling issue that William had was that the bones of his ribs were too soft which affected his lungs and breathing. William was brought to Dr. Jenner at thirteen months old, and was repeatedly examined by him until his death five months later. Although Jenner believed in the use of cod liver oil in the treatment of rickets, he believed that William was too far advanced in the disease, that all that could be done was to examine his progress. Over the five months William’s condition continued to worsen. He became even more emaciated because he would not eat properly, and his spleen and glands began to increase in size. His chest became more deformed and he became so tender that he could not stand to be touched or clothed. The concern over William’s lungs and ribs were well-founded since he died due to his lungs not being able to receive sufficient air, due to the compression of his lungs by his ribs. Jenner’s examination of the child after his death confirmed that all of the symptoms of rickets as then understood were present, and though he died from asphyxiation, Jenner believed his death was really caused by rickets.¹⁸⁶

These case studies are important because they demonstrate the social and medical aspects of the disease that were being examined by these physicians. They illustrate the symptoms that were present that led to the diagnosis, the family history of the patient and

¹⁸⁵ Jenner, *Clinical Lectures*, 58.

¹⁸⁶ Jenner, *Clinical Lectures*, 59. Although Jenner believed that William’s cause of death was rickets, today these symptoms are also associated with hypophosphatasia (which according to the U.S. National Library of Medicine is an inherited disorder that affects the mineralization of bones and teeth). Although William may have suffered from rickets as Jenner believed, if it was hypophosphatasia this demonstrates the ways that diseases could be confused with one another through the symptoms presented in clinical observation.

the effect that may have had on the development of the disease, and they demonstrate the treatment methods used and if they were successful. Through these case studies, British physicians largely rejected the theory of heredity in rickets, and instead focused on a faulty diet as being the primary causal factor. This was a very different approach compared to that of most French physicians, who still believed that heredity played an important role in the causation of rickets.

Case Studies in France

A typical French case study is found in Chonnaux-Dubisson's *Du Rachitisme* discussed in the previous chapter. The case studies that he provides give insight into how the case study in clinical medicine was central to French physicians' studies of rickets.

One of Chonnaux-Dubisson's most important case studies revolved around three siblings from the Bruet family, Louis, Jean, and Camille. He examined each sibling carefully in order to determine the causation, symptoms, and treatment for each of their cases. As discussed in the previous chapter, Chonnaux-Dubisson wanted to believe in the heredity theory posited by many well-known researchers, however most of his case studies did not demonstrate that this theory was entirely plausible. Despite this, Chonnaux-Dubisson did not rule out heredity as a factor, as can be seen from his case studies involving the Bruet family. He begins with a family history that shows how the Bruet parents were not healthy, and he assumed that this affected the health of their children. The father, which he described as "lymphatic" was forty-seven years old when

Louis was born.¹⁸⁷ The mother, who was twenty-two years old, suffered from an abscess in her breast during feeding and was only able to breast-feed Louis for eighteen days. With these health problems in the parents, the lack of breast-milk, and a diet of boiled wheat and milk, Chonnaux-Dubisson posited a multi-causal etiology of rickets: in this case faulty diet and heredity, in Louis and his siblings.¹⁸⁸

Chonnaux-Dubisson began with a thorough analysis of Louis' development and treatment. Louis was thirteen months old when he was brought to the hospital with rickets. From his parents he learned that Louis had been a sickly baby. The Bruet parents became aware of Louis' condition after he had recovered from the measles but did not regain his appetite. Although he had been able to walk at eleven months, he was soon too weak to do so, and also became increasingly thin, and sensitive to touch. Due to these issues he was put into Chonnaux-Dubisson's care.¹⁸⁹

Chonnaux-Dubisson began his examination of Louis by looking at what other symptoms were present in the child. He noticed that Louis presented many of the signs of rickets, including bent bones in the legs, as well as no sign of developing teeth, despite the fact that he was constantly chewing on his hands. Louis also suffered from excessive sweating, which was also seen as a sign of rickets. It was through these observations as well as the knowledge that Louis' siblings suffered from rickets that Chonnaux-Dubisson was able to create a treatment for Louis that focused on correcting his faulty diet caused

¹⁸⁷ According to the U.S. National Library of Medicine "lymphatic" is defined as 1): of, relating to, or produced by lymph, lymphoid tissue, or lymphocytes <lymphatic nodules> 2: lacking physical or mental energy.

¹⁸⁸ Chonnaux-Dubisson, *Du Rachitisme* 71-72.

¹⁸⁹ Chonnaux-Dubisson, *Du Rachitisme*, 72.

by lack of breast milk.¹⁹⁰ For two months, at the hospital, Louis was fed a diet that consisted of a spoonful of cod liver oil in the morning and at night, four spoonfuls of quinine syrup a day, red meat, iodide of iron, and milk. Chonnaux-Dubisson stated that after five weeks it was obvious that the treatment was working, and after two months Louis was no longer recognizable because he had become much stronger and more vigorous. Chonnaux-Dubisson had the Bruet parents continue this treatment and discussed with them the importance of good hygiene and diet.¹⁹¹

Chonnaux-Dubisson concluded his report by noting that Louis was able to regain his health and at nine years old was strong and healthy. Writing in the multifactorial mode, he argued that an unhealthy diet and the health of his mother are what caused Louis to develop rickets. He stated that “Cette Observation n'est pas sans intérêt; nous voyons, en effet, que l'allaitement naturel pendant 18 jours, puis l'allaitement artificiel mal ordonné, joints à une nourriture malsaine, ont coïncidé avec le développement du rachitisme chez le jeune Louis; je dis même que ce sont là les véritables causes déterminantes du rachitisme chez lui”.¹⁹² He showed that although Louis had measles, the only effect that this had in the development of Louis' rickets was that it affected his diet, from which he did not recover until the treatment was administered. Louis was not the only one to suffer from rickets in his family, however, and he was the least severe case of the Bruet siblings.¹⁹³

¹⁹⁰ Chonnaux-Dubisson, *Du Rachitisme*, 72.

¹⁹¹ Chonnaux-Dubisson, *Du Rachitisme*, 73.

¹⁹² Chonnaux-Dubisson, *Du Rachitisme*, 74.

¹⁹³ Chonnaux-Dubisson, *Du Rachitisme*, 74.

Chonnaux-Dubisson also examined Jean and Camille Bruet in the hospital. Like Louis, Jean and his twin brother Camille, were not breast-fed as infants. Instead they were fed wheat porridge made with water, (which was insufficient in providing them the nutrients that they needed to grow). The twins also suffered due to the family's poverty, Chonnaux-Dubisson stated, "A cause de l'indigence des parents, il eut à endurer toutes les privations de la misère: vêtements insuffisants, nourriture trop peu abondante et mal préparée; habitation insalubre, humide, étroite, mal fermée".¹⁹⁴ Here, Chonnaux-Dubisson is making some important observations. As discussed in the previous chapter, Chonnaux-Dubisson's multi-causal explanation of rickets included factors such as clothing, diet, and environment. Here he is showing a case that contains these factors, showing that the Bruet brothers support his claims about the multi-causal factors of rickets. It was due to these conditions that both twins developed rickets, and in a much more extreme case than their brother Louis.¹⁹⁵

Although the first symptoms of rickets appeared in Jean at the age of fourteen months according to his parents, Chonnaux-Dubisson did not examine and diagnose him until he was three years old. By this time Jean had suffered deformities in his wrists, feet, spine, and legs. Like Louis, Chonnaux-Dubisson prescribed a diet that focused primarily on cod liver oil. Due to the severity of Jean's rickets compared to Louis', Jean's treatment lasted for much longer than Louis'. Jean was on a diet of a spoonful of cod liver oil taken twice a day for seven months, as well as a diet like that of Louis which consisted of healthier, more nutrient-rich food. After seven months of this treatment,

¹⁹⁴ Chonnaux-Dubisson, *Du Rachitisme*, 75.

¹⁹⁵ Chonnaux-Dubisson, *Du Rachitisme*, 74-75.

Chonnaux-Dubisson stated that Jean was cured of his rickets. However, unlike Louis, Jean was not diagnosed and treated until much farther into the disease, and as a result he was left with deformations of the bones that left him with a noticeable disability.¹⁹⁶

Camille Bruet's treatment and recovery was not as easy or successful as that of his brothers. While Camille suffered from the same conditions and symptoms as his twin brother Jean, he was not able to digest cod liver oil. This made it much more difficult for him to recover. Chonnaux-Dubisson shows that he directed the Bruet parents to adjust Camille's diet like his brothers' but without the help of the oil. Although he did eventually recover, he too was left with noticeable disabilities. His recovery time was much longer compared to both of his brothers.¹⁹⁷

These case studies involving the Bruet brothers are very important because they show not only how rickets was viewed, but also how it was treated in cases of patients at various stages of the disease. While Louis, the youngest brother, was treated at a younger age and during the early stages of the disease, his brothers were treated at the ages of three years old and had suffered through the disease for over two years, making their cases much more advanced. By examining these siblings, Chonnaux-Dubisson demonstrates why many French physicians believed rickets was hereditary, since it often affected many members of the same family, however due to his conflicted view on heredity, he believes other factors contributed to the development of rickets in the Bruet brothers. He also shows how the disease could develop differently in different children depending on the stage to which the disease had developed, and the point at which

¹⁹⁶ Chonnaux-Dubisson, *Du Rachitisme*, 75.

¹⁹⁷ Chonnaux-Dubisson, *Du Rachitisme*, 76.

treatment had begun. While cod liver oil was successful in treating both Louis and Jean, despite the different stages of the disease, Camille had to suffer through a longer and less successful treatment due to his inability to digest cod liver oil.

Conclusion

These case studies illustrate several important factors in the history of the understanding of rickets. These include the rejection or acceptance of the heredity theory, the use of clinical observation, the complexity of symptoms, as well as ideas about treatable and non-treatable cases. Physicians in both countries also demonstrated that although they knew that cod liver oil was effective as a treatment, they also believed that a good diet was essential for the recovery of their patients. This is important because it shows that although they knew that cod liver oil was a successful treatment option, they did not know why it was successful. This knowledge was not something that would be gained until the discovery of Vitamin D and an understanding of how important this was to the health of a growing child. Through the discovery of Vitamin D, the way that rickets was treated began to change as physicians realized that cod liver oil was not the only effective treatment that could help replenish Vitamin D in the rachitic patient.

By examining the different case studies from Great Britain and France during the late nineteenth century, the commonalities and differences of views and treatments can be seen in regards to the British and French physicians. Clinical observation was an important medical approach used by physicians in both countries, and this approach can be seen through these case studies by the examination, diagnosis and treatment of the patients. Clinical observation let the physician get a better idea of the history of the

patient, the symptoms and signs they presented and what causal factors may have influenced the development of the disease. While both British and French physicians looked for the same symptoms in diagnosing rickets, and also believed in a treatment that focused on cod liver oil, there is one big difference that can be seen in their approaches. When British physicians examined the health of the family in the case they studied, they did so to get a better understanding of the environment and diet of the child. However, most French physicians studied the health of the family to see if hereditary predisposition could be a causal factor. While physicians in Great Britain did not believe that rickets was hereditary, the French physician Chonnaux-Dubisson believed rickets was hereditary in part and focused on the health of the family, as seen through his case studies involving the Bruet brothers. Although he demonstrated this was not the primary cause of their rickets, but that a faulty diet was, he still put a large focus on the health of the family and how this may have contributed to the cases of rickets seen in the Bruet brothers. Through his examination he showed that although the mother was syphilitic, he argued that this did not affect her first-born child, but instead affected her two youngest children whom she was unable to breast-feed. Chonnaux-Dubisson demonstrates the reluctance of the French to acknowledge diet and malnourishment as the primary causes of rickets, and as a result affected the way that French children with rickets were treated. This work also illustrates the way that the British were more advanced in their causal understandings of rickets, due to their rejection of the hereditary theory and their willingness to focus on diet and environment.

Conclusion

This thesis has shown that rickets was viewed as a significant problem in both Great Britain and France in the late nineteenth and early twentieth centuries, but was framed differently by physicians and researchers in these countries due to different medical, social and political factors. In both countries population anxieties and a rising concern over children's health provided a context for how physicians and researchers framed the disease. The multi-causal way of looking at rickets that predominated until the twentieth century was a way for them to understand the factors that to them seemed to be involved in causation. This approach was typical in an era in which physicians were struggling to understand the causation of different diseases. In the case of rickets causal factors including diet, environment and heredity, typified the era before the discovery of Vitamin D. My examination of the work of physicians and researchers in both countries has also shown how clinical and experimental methods were utilized by researchers in the search for the causation of rickets. Finally, I have shown through this comparative approach the notable emphasis on heredity as a causal factor in France.

As discussed in Chapter One, both countries were facing population anxieties due to war, a declining birth rate, and rising infant mortality rates. Due to these apprehensions, population and health became two prominent concerns politically and socially. This concern began to center around children's health as a result from the belief that healthy children equaled healthy and populous future generations. Through this concern for children's health many physicians and researchers began to examine children's diseases, hoping to better understand and help eradicate them, therefore helping to lower the infant and child mortality rates as well. Ultimately, research on the

treatment and cure of rickets was an attempt to ensure these productive future generations and to ease population anxieties.

Through the examination of rickets in children, physicians and researchers in both of these countries demonstrate the prevalence of a multi-causal approach. These multi-causal factors were often framed by social and medical beliefs and demonstrate the effect these beliefs could have in the diagnosis and treatment of a disease. In France, where the heredity theory was very prominent both medically and socially, physicians and researchers relied on heredity as a dominant causal factor throughout the nineteenth century and into the twentieth century. Schneider and others point out that hereditarian thought had a great stronghold in France during this time due to its ideological support for eugenics. This thesis, however, while it clearly shows the importance of the heredity theory in France, cannot explain specifically why the theory had such a lasting influence for physicians and researchers in the explanation for the causation of rickets long after it had been generally discarded in Great Britain. In Great Britain, where the heredity theory did not have as great a following, physicians and researchers eventually dismissed the thought that heredity had any influence on the causation of rickets. Instead, British researchers focused on problems such as industrialization and poverty, and believed these could be factors in the causation of rickets. This shows how different social and medical understandings could frame the way a disease and its causation were viewed and addressed. The multi-causal approach, while important in both countries, was essential in France in order for physicians and researchers to explain how some of the patients in their case studies did not fit into the heredity theory. Due to this, physicians and

researchers had to find other causal factors such as diet, clothing, and climate to explain how children without a hereditary predisposition for this disease could acquire it. In Great Britain, although some other factors were posited by physicians and researchers, most focused solely on diet and environment as the primary causes of rickets. Although, the primary causal factors were framed differently in Great Britain compared to France, the same treatment was administered in the quest to cure rickets, cod liver oil.

While physicians and researchers in Great Britain and France made many important contributions to the study and treatment of rickets, other physicians and scientists throughout the world also provided significant contributions. During the time that researchers in Great Britain and France debated the causal factor of rickets, experimental medicine moved closer to an understanding. This work included Edward Mellanby's (Great Britain) work with puppies, Kurt Huldschinsky's (Germany) work with UVB rays and mercury lamps, and Elmer McCollum's (United States) discovery of the anti-rachitic vitamin through his work with albino rats. Thus researchers were able to discover in 1922 that rickets was caused due to a deficiency of Vitamin D.¹⁹⁸ The cure for rickets, and the discovery of Vitamin D were truly cross-cultural achievements.

The discovery of Vitamin D was essential in determining the causation and treatment of rickets. Vitamin D is a very important part of a child's developing body, enabling it to mineralize the bones and enable cell growth. Without this vitamin, children did not metabolize calcium and phosphates, and their bodies were not able to promote proper growth. However, with the discovery of the function of Vitamin D as well as the

¹⁹⁸ Frankenburg, *Vitamin Discoveries*, 104.

knowledge of how it was obtained, physicians were able to discover the causation and treatment for rickets. With the knowledge that Vitamin D was contained in certain foods such as cod liver oil and also in UVB rays produced by the sun, or artificially through mercury vapor lamps, physicians were able to encourage families in the importance of a healthy diet as well as the importance of sunshine. Prior to the discovery of Vitamin D, as this thesis has shown, physicians had adopted successful treatments, particularly cod liver oil. Also, they had realized that breastfeeding was preventative.

However, this discovery would not have been possible if not for the cross-cultural influences that caused scientists and physicians to examine rickets and its etiology. Realizing that this was a problem not just in Great Britain and France, but also in countries such as Germany, Austria, and the United States, researchers and physicians in these countries turned to clinical observation and experimental medicine, and began documenting their cases and conducting experiments in order to find the causation of this disease. It was through this work that knowledge on rickets, its symptoms, causes and treatments began to expand. Building on knowledge from others experimenting with the disease, scientists such as McCollum were able to narrow down the deficiency and observe exactly what caused rickets to develop in animals and children. It was through the discovery of Vitamin D and the understanding of its role in the developing body that scientists and physicians were able to develop more exact treatment plans for rickets that would help contain this disease which was such a problem in Great Britain and France.

Rickets is important because its study incorporated two of the most important medical approaches at the turn of the twentieth century. In the treatment and cure of

rickets there were two distinct methods used, the clinical and the experimental. Although both methods were developed in France, the British were more successful in using these methods to discover the causation of rickets. As shown in Chapter Four, clinical observation through case studies was used in both countries in diagnosing, examining, and treating rickets. Although experimental medicine was very important to France, where it was firmly established by Claude Bernard, it was the British, mainly Edward Mellanby, who successfully used this approach and was able to fully understand that diet and environment were the main causal factors, and to rule out other causal factors such as heredity and contagion. Although some experimentation did indeed take place in France by Jan Raczynski, French physicians and researchers' inability to look beyond heredity as the primary cause of rickets made it impossible for the French to understand the true causation of rickets. The British, on the other hand, more successfully utilized the experimental model, and were willing to acknowledge environmental and dietary factors, thereby completely dismissing heredity, which ultimately influenced the discovery of Vitamin D and the cure for rickets.

The search for the causation of rickets was more than just an attempt to cure the disease. It was an attempt instead to ease population anxieties caused by war, poverty, and other social ills. Rickets, a childhood disease, illustrates through these anxieties and the ways in which they were addressed, the way that societal and medical views shaped the diagnosis, examination, and therapeutics for rickets. In looking at this disease and the different factors that helped frame the way it was addressed, physicians and researchers in Great Britain and France effectively developed methods to improve children's health.

This thesis has shown the nature of the multi-causal explanatory model in rickets and its relations to clinical observation. My comparative approach has also underscored the longevity of hereditarian thought in France and has shown how British research came to focus on diet and environment.

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