Spring 5-1996

East Meets West Pharmaceutically and Economically

Grace Hung-Lin Shih
University of Tennessee - Knoxville

East Meets West
Pharmaceutically and Economically

Grace Shih

Senior Project

May 2, 1996

Faculty Mentor: Dr. L. Evans Roth

Southeast Asia is the hot spot for chemical and pharmaceutical investments these days. American and European companies are finally realizing the business and scientific potential of the Asian world. The Greater Chinese area in particular is a focus of Western investments and developments. Greater China is the area contained by Korea, Taiwan, Hong Kong, and China. They are individually and corporately growing and advancing due to the huge amount of business with Western multinational corporations. These corporations, in turn, are also growing and advancing due to their involvement with Greater China.

As a result of this increased fascination in southeast Asia, the economy there is booming. The Asian countries have adapted well to accommodate for such growth and change. In fact, China's economy has grown so much that it has risen to be one of the largest in the world, making China a major player in the international market. This paper will discuss the pharmaceutical industry's developments and its influence on the economy at the present time and in the future.

Greater China offers resources of environment, labor, and traditional medicinal knowledge.

To understand the growing interest in the area, one must look at Greater China and what it has to offer pharmaceutical companies. Only about two decades ago, these same companies were reluctant to spend a

penny in the Eastern direction. Greater China is definitely a land abundant in resources, especially in plant species, human labor, and Chinese folklore knowledge of botanical medicines. These resources are eye-catching in the pharmaceutical industry where such resources can be scarce.

Because a large percentage of medicinals are derived from plants, pharmaceutical companies are consistently seeking new areas for botanical research. Southeast Asia has been an attractive area due to its variety of habitats but especially because of its vast tropical rainforests. These tropical rain forests are rapidly decreasing in South America because of deforestation, reducing species diversity (24). China, is working to promote afforestation (39, 81). At the current rate of deforestation, one species is lost every ten minutes. If one-half of the tropical rainforest areas were to be destroyed today, one million species would die (24). This gives reason for alarm since two-thirds of the world's species are believed to be contained in these types of forests (24). Many scientists also believe that a majority of the most sought after disease cures can be found in these species-rich, exotic forests. Therefore, researchers and developers from large multinational corporations are gradually moving into the Chinese area to make use of the species diversity before it vanishes.

A prominent example of a plant-derived drug is Taxol, the anticancer drug first produced by Bristol Myers Squibb in 1992. It poses as a second-line therapy in the treatment of refractory metastatic breast and ovarian cancer (34). Now it is produced semisynthetically from the twigs

and needles of the Pacific yew tree, yielding sales of $345 million in 1994 (34).

Human labor is another key variable in luring Westerners into the Chinese territory. Commonly known as a land of people, Asia possesses one-half of the world's population and by the year 2000, two-thirds of the world's people will reside there (11, 15). China alone constitutes one-quarter of the world's population (42, 2-286) with approximately 1,190,431,106 inhabitants (42, 2-287).

The Asian workforce began to grow quickly in the 1970s as a result of the baby boom of the 50s which rolled on to various countries into the 1990s (29, 51). The Asian workforce is predicted to continue to rise until around the year 2010, which by then, will increase the workforces of China and South Korea to about one-fourth the current size (29, 51). Smaller Asian countries will grow even more.

Hungry for development, these countries are taking advantage of their massive workforces to lure Western currency into their area by offering low labor costs. As a result, some companies have actually moved their labor intensive plants from Europe to Asia. Overall, the Asian cost is 80% lower than that of Germany (4, 34). These costs cover labor, energy, and environmental costs. Another attractive feature about the workforce is that it consists of well-educated young people and if they are not so educated, they are definitely motivated (29, 56).

In addition, the Chinese possess a great deal of plant knowledge, as shown in their practice of ancient herbal medicine. Although acupuncture is more prominent in the Western world, the herbal treatments are less well-known but are increasing in popularity. In the Asian society, herbal

treatments are highly regarded because they have proven to be effective against disease in clinical practice and have contributed to the treatment of chronic diseases (26). This is evident in the street market as herbal medicine shops are just as numerous as regular pharmacies and apothecaries (6). As Western companies are being exposed to this form of medical care, traditional Chinese medicine is given an opportunity to share its knowledge.

Western companies are undertaking million-dollar projects, taking full advantage of Greater China's resources.

Corporations which recognize the environmental, working, and traditional values of Asia have begun to invest in Greater China. Roger Shamel of Consulting Resources says that it would be easier to join the local Asian producers than to try to beat them (18). Some companies have done just that, joining efforts with Asian institutions, allowing small and medium sized enterprises to participate in the market too (1). Ventures like these will help certain companies achieve their goals of expanding into the Asian Pacific Rim, and cheaply, particularly in mainland China. In return, the Chinese get to work with the most modern technology available.(4). In 1993, 3059 companies were operating in China with the majority of the partners from the United States, Europe, and Hong Kong, producing $8 billion of products (27). Listed below are summaries of some recent and major investments. A map is provided in the appendix for geographical assistance.

*BASF is setting up a joint venture with China's North East General Pharmaceutical Factory (NEGPF), one of the largest vitamin and pharmaceutical makers in China, for the production of vitamins and vitamin blends. BASF will hold 70% and NEGPF 30% in the new venture in building vitamin plants to serve China's fast-growing nutrition market. The venture plans to build two new plants, both due onstream by 1997 for the dry-powder production of vitamins A, D3, E, and vitamin blends. The projects are estimated to be around $30 million. This is the first venture between a Chinese vitamin producer and a Western partner (37).

*Pfizer Inc., which allotted $1.5 billion for plant-drug development and research in 1995 (34), and the Institute of Basic Theory at the China Academy of Traditional Chinese Medicine have made a three-year agreement to study traditional Chinese herbs as sources of potential new medicines for human and animals, excluding any endangered species (26). Extracts obtained from these experiments will be screened and tested for substances effective against specific disease targets, using tools of molecular biology and biotechnology including human receptors and gene targets (26; 34).

*Ciba, with designs for 30 projects in China(17, 18), has made an agreement with China's Institute of Microbiology and Epidemiology, the Kunming Pharmaceutical Factory, and Citic Technology to develop and antimalarial drug, with hopes to market the drug as early as 1997 (30). Ciba is also working with the Beijing Institute of Botany and the Chinese Academy of Science to obtain extracts of

plants associated with traditional healing. According to the company spokesman, the plants are being screened by Ciba for bioactivity against cardiovascular diseases, central nervous system disorders, bone inflammation, cancer, and arthritis (34).

*Rhone-Poulenc has gone ahead with four out of fifteen joint ventures (a total of $30 million), one of which includes a 60-40 surfactants joint venture at Wuxi, Jiangsu province with Wuxi Chemical. This unit will supply Western consumer products manufacturers, such as Loreal, Johnson & Johnson, and Colgate, which will be operating in the region. Other ventures include a collaboration with the Chinese government to make cigarette filter tow for the state-owned cigarette industry, plans with local partners to produce a rice insecticide in China and Vietnam and investments in health care and chemicals. Rhone Poulenc hopes that Asia will represent 12%, as opposed to the current 7.4%, of total sales by the end of the century (40).

*Amgen has set up a wholly- owned subsidiary in Hong Kong called Amgen Greater China Ltd. to provide marketing and technical conducting clinical trials in a leading Chinese oncology center with its granulocyte colony-stimulating factor Neupogen, also known as filgrastim, and plans to introduce its interferon products in China for the treatment of hepatitis C (3).

* Copley Pharmaceuticals has set up a 49-51 operation with Chai Tai health care group to distribute and manufacture generic drugs. Fifty-one percent of Copley is held by the German

Hoechst-Celanese. Investments by Copley will total up to $8 million over the next 3 years (8; 9).

*Allergan Corporation has plans to build a $27 million eye medicine product facitlity in Hangzhou, capital of the eastern Zhejiang province. Construction of the facility, the largest of its kind in Asia, began late last year (2).

*Pharmagenesis, a privately owned Californian-based firm, has teamed up with a Taiwan-based international publishing network, United Daily News, to integrate traditional Chinese medical clues with modern science to develop better alternate therapies. One area of concentration is to find a drug used to stimulate blood cell growth, especially in patients with bone marrow supplements. This drug will be aimed at the estimated $300 million Chinese market. The other focus is on antirejection drugs for kidney transplants, a $70 million Chinese market (34).

Of course, this list is only a handful of the companies investing in the Greater Chinese are, not to mention those investing in the more developed country of Japan. Even health care specialists are considering expansion into Asia. For example, Nypro, a plastic mold designer and manufacturer, has also identified the Asia-Pacific as the fastest growing market for its industry and has already established two shops in Singapore to serve southeast Asia (23). Likewise, Medtronic, the leader in the worldwide heart pace-maker market, is making significant inroads into the People's Republic of China (35).

Two pharmaceutical interests in the Asian area are in the generics market and in the herbal market.

As a result of the intense research and development undertakings, many plant-drug derivatives have demonstrated their effectiveness in the generics and herbal markets. These are predicted to make millions for their respective companies, just as Bristol Myers Squibb's Taxol did.

Pharmaceutical companies are very familiar with the generics market. Since hospitals and managed care administrators are sure to purchase generics over brand anmes, the presence of the generic market will remain strong. In the past, Italy, Ireland, Hungary, Spain, and the Czech Republic have been common sources of bulk actives necessary for generic production. Asia has now been recognized as a main supplier as well. India and China are at the top of the list of Far Eastern sources (14, 44; 21). However, secondary manufacturing, the formulation and packaging of drugs, will continue in the main pharmaceutical market like Europe, North America, and Japan because they need to be close to the local markets (21).

China has sales of about $3 billion per year in making bulk drugs for worldwide pharmaceuticals and that figure is sure to rise. For some time, China has been producing basic vitamin supplements (14, 44), some antibiotics, and pain killers (21) and is now progressing into nitroparaffins and sulfur drugs, as well as more sophisticated drugs such as the important heart drug, Captopril (14, 44). Furthermore, a large amount of patents for common prescription medications will expire in the next five years, increasing generics potential. About $60 billion worth of

pharmaceuticals will lose protection (14, 44). In 1994 alone, drugs such as Tagamet, Depo-Provera, Rimadyl, and Seldane expired (14, 46), allowing any capable drug firm to offer generic versions of these prescription drugs, which have brought their respective originators billions of dollars.

The generics market is a competitive one. Industry sources say that generics could eventually reach 60% of worldwide prescriptions in the near future (28, 39). In Germany, generics sales total 40% of prescribed drugs (28, 39). Naturally, companies are striving to be the biggest and best in the industry. Greg Ramsey, president of Strategic Analysis, estimates that "90% of the top drug manufacturers are involved in the generics business at some point in the stream." (14, 44). Among those are Glaxo, Wellcome, Pfizer, Parke-Davis, and Rhone-Poulenc (14, 44). Bayer, a German chemical and pharmaceutical producer, expects to be a leader in the marketplace, according to the CEO Manfred Schneider (28, 39). The company has taken over several smaller companies such as the Denver-based Schein Pharmaceutical to boost its efforts (28, 39). Hoechst-Celanese also has plans to be a key supplier in North America, and has opened two bulk active plants with Copley Pharmaceutical (14, 45).

In the same manner, the herbal market is taking off. Supermarket sales of herbal supplements increased 70% in 1993 (19). Modern scientific research has discovered new taxa and new drug resources from basic Chinese traditional therapies (41, 103). Crude drugs have been carefully analyzed qualitatively and quantitatively. From there, optimal conditions for cultivation and breeding of plants have been formulated, the quality of some drugs have been controlled, drug processing and storage conditions

have been evaluated, and the chemistry and pharmacology of the studied drugs have been clarified (36).

One of these natural products is an alkaloid compound called huperzine A, a drug that has been used by folk medicine to improve the memory of elderly people. It holds promise for relieving the symptoms of Alzheimer's disease, which involves a chemical depletion in brain levels of acetycholine, a neurotransmitter associated with learning and memory. Huperazine A reverses the depletion of acholinesterase, an enzyme that catalyzes acetycholine breakdown (22). Even though it is not a cure, huperzine A is an optimistic step in the treatment of Alzheimer's disease.

Gossypol has also been studied as an anti-viral drug. It is an undesirable component of cottonseed oil which has proven effective as an anticancer agent against multi-drug resistant cells. It targets viruses such as herpes simplex, parainfluenza, and an AZT-resistant strain of HIV, but gossypol's mechanism is not yet understood. Chinese herbalists have used gossypol as a means of male birth control (13).

Another effective drug has been found in the Ephedra plant, grown solely in China for medicinal purposes. The plant contains natural pseudo-ephedrine which offers relief, without drowsiness, from nasal and sinus congestion due to colds or hay fever. (19)

An herbal Chinese tea has even been found to have soothing effects for people with severe eczema. The main ingredients of the drink were first described in the ancient treatise of the Inner Classic of the Yellow Emperor, written around 100 B.C. (15, 11). Victims of eczema may have sores and unbearable itching anywhere on the body. So far Western treatment provides only temporary relief and the Eastern remedy has

offered some hope. the treatment must go through more trails before it can be licensed and marketed (16, 54).

Still, there are more. The most common Chinese herb, ginseng, provides a tranquilizing effect at low doses and can increase circulation, lower blood pressure, and stimulate hematopoietic bone marrow tissue. Sweet wormwood contains the active compound artemisinin which has shown effects against malaria. However, FDA standards have not been met and it is not being used by the World Health Organization despite a need for treatment for the incurable malaria, the most serious public health problem in the world with new resistance strains to the current malarial drug (7).

The newfound growth in Asia is causing an economic growth spurt, domestically and internationally.

All of these new and exciting discoveries and relationships with foreign countries have significantly impacted the Asian economy. Asian economic growth is booming and has placed China alongside the United States and Japan in the international market (29, 345). In response, Greater China has evolved to conform to the many changes that is occurring, and will continue to adapt as long as there is growth.

Looking at the Pacific Rim area only, China possesses the largest market size. The index of market size is constructed by combining various indicators--population size (given double weight), urbanization, private consumption spending, electricity consumption, steel consumption, newsprint consumption, telephone usage, registered automobiles, and use

of television sets--to arrive at a common figure that expresses the relative size of the market. The double weight for population size works to China's advantage (5, 82).

TABLE 1-INDEX OF MARKET SIZE

Country	%of Pacific Rim Market
China	32.27
India	23.57
Japan	20.71
Indonesia	5.39
Korea	2.27
Philippines	2
Thailand	1.82
Taiwan	1.42
Hong Kong	0.57

(5, 82)

In the same sense, the index of market intensity below is another tool for assessing markets, putting more emphasis on wealth rather than on size. Its indicators are the same as those for the index of market size but double weight is given to private consumption expenditure, urbanization, and passenger car ownership (5, 83). Japan, as expected, ranks the highest, with China and the rest of the region falling behind. Again, population is a securing factor for China.

TABLE 2-INDEX OF MARKET INTENSITY

Country	Index Numbers (avg=1.00)
Japan	7.85
China	2.4
India	1.96
Indonesia	0.55
Korea	0.52
Taiwan	0.4
Philippines	0.28
Thailand	0.23
Hong Kong	0.19

(5, 83)

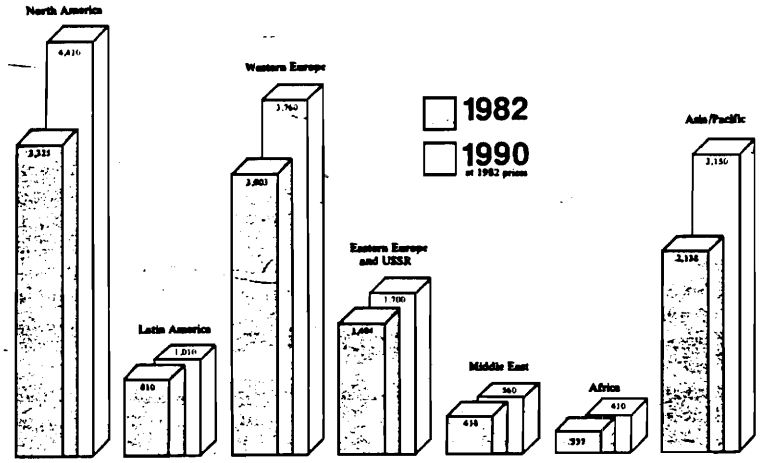
The gross domestic product (GDP) has also increased remarkably in the past twenty years. The GDP is important because it represents the total final output of goods and services produced by the country's economy, within the country's territory regardless of its allocation between domestic and foreign claims (31, 680). The tables below show the steady rise that Asia-Pacific has experienced in terms of the GDP.

TABLE 3-GDP, REGIONAL SHARES (% OF WORLD TOTAL)

Region	1972	1982	1990
North America	30.4	29.1	29.4
Western Europe	29	26.3	25.1
Asia/Pacific	15.1	18.7	21
Eastern Europe & USSR	18	13.3	11.4
Latin America	4.4	7.1	6.7
Africa	1.9	2.9	2.7
Middle East	1.2	3.6	3.7

(5, 80)

FIGURE 1-GROSS DOMESTIC PRODUCT IN US $BILLIONS



(5, 80)

Japan, because of its high technology, and China, because of its large consumer market, obviously lead the economic activity in the Pacific Rim. The "four tigers" or "four dragons"--Singapore, Hong Kong, Taiwan, and South Korea--are the newly industrialized countries that are quickly approaching the industrial levels of Japan and the West(5, 79). The lesser developed countries of Indonesia, Malaysia, Thailand, and the Philippines will also grow considerably throughout this decade (5, 79).

Labor, capital, and education will help to promote growth in the next few years.

To ensure continued growth, several factors must come into play. These would have to be the same ones that encouraged Westerners to invest in the first place--labor, capital, and education. Asia is already steadily working to keep business up. In fact, the vice-minister of China's chemical industry invites more businesses to enter the arena. He says that "there are still many excellent opportunities for investment" (12, 44).

As mentioned earlier, the Asian workforce is expected to grow tremendously in the coming years. The labor force is also well-driven by a serious work ethic. When comparing work weeks, South Korea's week is ten hours a week longer than Japan's and fifteen hours longer than West Germany's. (29,52). Most offices in Hong Kong still open for a half-day on Saturday, and other shops stay open until midnight. (29, 52). Also in Hong Kong, taxes are extremely low and entrepreneurialism is high, making work more attractive than in other places (29, 52). The vigorous work ethic is instilled in children at an early age. It is not unusual to see children doing calisthenics at 6:00 A.M. on a Saturday mornings before going off to school (29, 58). These same children spend longer hours and more weeks in school than Western children, and they do more homework per day (29, 58).

Asia is also making tremendous strides in controlling capital. By the early 1990s, East Asia was saving about 35 percent of GDP (10, 15), twice as much as Latin America and the United States (29, 53). This is necessary to provide physical capital to form equipment, roads, computers, and technological investments. In an attempt to encourage those in the countryside to start saving formally, savings flourish in East Asia because interest and capital gains remain untaxed and inflation is extremely low (29, 54). East Asia is currently investing almost as much as it saves, which has helped the economy to rise in times of weak private investment (29, 54-55).

Education is yet another strong feature of the Asian culture. The current Asian workforce is stocked full of well-educated young people, and their skills are being increased (32, 161). In South Korea, there are more

PhDs per capita than anywhere else in the world (11, 207), and Taiwan and South Korea is dominated by a thick layer of engineers (29, 330). By the mid 1960s, the four "dragons" had already achieved universal primary education--an achievement made more than a decade ahead of other countries at their income levels (32, 161; 29, 56). Now, literacy is common, and secondary and tertiary educational enrollments are growing, while technical and managerial skills have been building in parallel with industrial growth (32,161).

Because of fast economic growth, a gradual decrease in population growth, and fairly equal income distributions (allowing even the poor to educate their children), conditions are optimal for improving education. There are two main concerns. The first is to concentrate spending on both primary and secondary education, as opposed to the Latin American ways of focusing on just university schooling. This method provides equal, basic training for all students, increasing the value of education in the society (29, 57-58). The second aim is to educate girls as well as boys. The non-discriminating effort will decrease the birth rate since educated females tend to produce less offspring. Also, educated mothers can give more encouragement and better teaching attention in the home (29, 58).

In addition, each country in the Greater Chinese region has individual problems to solve and hopes for the future.

Although the growth seen in the Greater Chinese area has been awesome as a whole, each individual country is adjusting differently. Each country has its own set of problems to work through and its own set

of aspirations. The one common goal is to remain active in the international market and to continue relations with Western companies, pharmaceutical or otherwise.

China...

China's growth has been driven by a phenomenal increase in foreign trade and investments. In an effort to continue prosperity, the Chinese government has devised a five year plan which began in March 1996 (12, 44). The plan includes a description of five "megatrends":

1. continued decentralization of the economy,
2. diversification of economic sectors,
3. increase numbers of wholly foreign-owned companies,
4. curb inflation, and
5. more-open international trade (12, 44).

Another improvement is the Chinese-American agreement on intellectual property rights which guarantees seven-year protection for new products and processes. This plan foresees increased investment in petrochemicals, fine chemicals, and pharmaceuticals.

The government also wants to consolidate the country's indigenous production to around 18 large multi-product companies. Another desire is to gain domestic control over research and design centers. By doing so, the government can promote technology transfer in joint-ventures (12, 46).

At the same time, China has a looming problem within the country. Most of the terrain consists of geographic barriers of steppes, deserts, and high mountain ranges lying mainly in the west (42, 2-286). As a result, the

population of China is hugely divided, with over 80% living in the eastern half of the country (42, 2-286). The rural regions contain 80% of the total population (29, 329), and the people must not be ignored if industrialization is desired.

The biggest dilemma that China faces is integrating a system in which the rest of the country can catch up to the already industrialized cities, otherwise growth will come to a standstill. The approach would have to increase the current level of literacy since approximately 20-30% of the population is semi-literate (29, 332), unlike the universal literacy found in the four "dragons." Some companies are already foreseeing this potential problem and arre already looking at the surrounding countries of Thailand, Malaysia, and Indonesia.

Hong Kong...

Hong Kong is currently the eighth largest trading entity, the biggest container port, and the sixth busiest foreign-exchange market in the world (20, 56). It has the best port on the Chinese coast, handling fully 70% of China's export shipments (20, 57). Hong Kong will revert back to Chinese ownership in 1997 (32, 165), but according to the Joint Declaration signed by China and Britain in 1984 provides that Hong Kong will retain its capitalist system and lifestyle for another 50 years (20, 57). However, there is still some uncertainty as to how Hong Kong's economic and political status will be affected.

Hong Kong's relationship with China is extremely vital. China is a large investor in Hong Kong and depends on Hong Kong's trading

infrastructure to increase exports (11, 229). Hong Kong has also provided economic progress for China since Hong Kong entrepreneurs account for 70% of all foreign direct investments in China (20, 58). Hong Kong, now a service and high-tech site, poses as a huge job-generator for South China, in areas of Shenzhen and Guangzhou (20, 58), and will continue to generate jobs after repossession.

As attractive as the open economy is in Hong Kong, the country is even more appealing for capital-intensive and technology-based firms since it is making land available at roughly one-third the market price in the newest of three industrial estates (20, 60). This encourages the establishment of production facilities in the colony which are close to Asian markets and have a excellent infrastructure, port, and workforce.

Among the problems that Hong Kong faces is that of the brain drain. This occurs when young educated professionals emigrate to join the workforce of another country (20, 62). They have collected their green cards to be assured of relocating if necessary, insurance policy for their children. Although the outflow has leveled off some, the migration still continues.

Taiwan...

Taiwan's economy is highly dependent on imports, mainly from China. The chemical industry in particular looks to Chinese suppliers to provide its chemical needs (33, 56). The dependency is only increasing, meaning that China has a strong hold on Taiwanese domestic affairs. China is actually using threatening military maneuvers to scare the

Taiwanese from declaring complete independence from China (33, 56).

As Taiwan is rising on the income scale, it is beginning to produce ideas to further the climb. Government intervention is requiring investors to bring technology with them and to set up research parks where pooled work is done so that smaller companies that cannot afford finances individually can participate (29, 77,). The intervention is meant to accelerate the impact of the upgrading of the firms' abilities, increasing foreign capital inflows. Also, Taiwan's thousands of returning entrepreneurs are bringing with them business practices and technology learned from Western business leaders (29, 77).

A country whose industry is comprised mostly of small, family-run business (11, 242). Taiwan and South Korea are beginning to allow foreigners to invest in a wider range of industries, to take a larger share of projects and to repatriate profits more easily (32, 167). This invitation to Westerners will increase business but will more than likely cause a labor shortage in Taiwan (32, 166), although its population density is the highest in the world(42-1356). The Taiwanese will have to increase their skills to keep up with increased business in the country.

What does the future hold for southeast Asia?

The future looks optimistic for Asia since there seems to be much room for new growth. Along with the new developments come new changes. Bank systems must change to fight inflation. Somehow, Asian banks must obtain sufficient credit to fund the private and joint-venture companies that are coming in (12, 44). And even though Asians are as

educated as they are, 89% of surveyed U.S. managers believe that China lacks qualified management candidates and skilled laborers (10, 44). Some companies are having their employees travel to the West to be trained in successful tactics in management (10, 47; 29, 330; 38, 36). Domestic spending will also increase and gradually replace export activities as the principal contributor to economic growth (5, 79).

As Greater China develops, the less developed countries in the southern portion of Asia will slowly assume the roles that are now held by their northern neighbors as the major beneficiaries of foreign investment (5, 79). Some of these ventures have already taken place. Japan will play a major role in sharing technology to the rest of Asia. Instead of competing with the other Asian countries whose advancements are inevitable, Japanese companies are beginning to work beside them and to push further technological development (5, 590). As long as this exists, by the year 2000, the Asian market is predicted to be as big as Europe's or North America's in terms of GDP and four or five times that in 2050 (5, 588).

My thoughts...

I believe that this development is exciting, especially for such an incredible amount of people. There is no doubt in my mind that the next few years will be strenuous, but I also know from personal experience that the Asian people are extremely determined and will be driven by their work ethic and thirst for knowledge (in first grade, I was a participant in the 6:00 A.M. calisthenics in Taiwan!). I also think that the people will want to be involved in this revolution and do whatever it takes to

contribute to the cause. A huge advantage that is a moving factor in Asia is its discipline and willingness to suffer to reach an ultimate goal. This is what will give the people hope in their times of confusion and hardship.

It is also my personal belief and hope that the extensive botanical research currently taking place in the forests of Asia will produce effective treatments for diseases. Being of Chinese descent, I have had a good amount of exposure to herbal traditional medicines and although I do not fully understand it, I do have faith in its abilities. Perhaps in conjuction with new discoveries found by research from the Human Genome Project, the global effort to discern the complete human genetic makeup, answers may be available to questions that have been asked for years. I pray that somewhere, in the depths of the jungles, lie the antidotes to cancer, AIDS, multiple sclerosis, and an endless list of incurable diseases.

APPENDIX 1-- MAP OF GREATER CHINA (39, 81)

APPENDIX 2--A COMPILATION OF MAJOR PHARMACEUTICAL AND HEALTH RELATED CORPORATIONS CURRENTLY OPERATING IN GREATER CHINA (derived from Directory of American Firms Operating in Foreign Countries. World Trade Academy Press, 1994)

1. 3M Co
2. Abbott Laboratories
3. American Cyanamid Co
4. Amsco International Inc
5. Amway
6. Bausch and Lomb Inc
7. Baxter healthcare Corp
8. Bio-Rad Laboratories Inc
9. Britol Laboratories
10. Cigna Corp
11. Colgate
12. Conair
13. Coulter Corp
14. Eli Lilly & CoCR Bard Inc
15. Dentsply International Inc
16. Dow Chemical Co
17. Eastman-Kodak Inc
18. Gerber Products Co
19. Gillette Co
20. International Chemical Corp
21. Johnson & Johnson
22. Merck Sharpe and Dohme International
23. Nellcor Inc
24. Pfizer
25. Procter & Gamble CoRespironics Inc
26. Rhone-Poulenc Rover Inc
27. SC Johnson & Son Inc
28. Sterling Products International Corp
29. Summitt Industrial Corp
30. Sybron Corp
31. Upjohn Co
32. WR Grace
33. Warner Lambert Co
34. Winthrop Laboratories

Grace Shih
Sr. Project Abstract
April 23, 1996

East Meets West

In the past three to five years, southeast Asia has increasingly been viewed as a haven of precious resources to many multinational corporations. Scientific and medical research companies such as Merck and Ciba have already invested millions of dollars per year into the Greater Chinese area, in the countries of Korea, Taiwan, Hong Kong, and of course, China. These countries lure western companies with promises of inexpensive labor, new scientific discoveries, capital returns, and land availability. Many companies are beginning to move out of Europe and to plant office bases in Greater China. In addition, significant joint ventures between power companies have evolved to further Eastern-Western relations in which both sides will benefit greatly.

Among these companies investing in Asia are the pharmaceutical companies. They are taking advantage of the area's vast tropical rainforests. Tropical rainforests are believed to contain two-thirds of the globe's species and are diminishing in area due to deforestation. Researchers are going in to look for species that may advance medical efforts to cure and/or treat many diseases. Western companies are also beginning to recognize the importance and effectiveness of ancient herbal and botanical treatments in the Asian society and are further researching this aspect as well.

Although this project was originally intended to be biologically based, I soon discovered that southeast Asia's economic status is extremely significant because of the area's rapid growth and changes. This has caused China's economy to become one of the largest in the world, alongside countries such as the United States and Japan. Because of the role that Asia is playing and will grow to play in international affairs and domestic growth, I felt that this topic should also be addressed in my paper.

REFERENCES

1. "ACHEMASIA 95 ready for next spring in Beijing." Chemical and Engineering News. 27 Jun 94, 22.

2. "Allergan targets China for $27 million factory." Ophthalmalogy Times. 11 Sept 95, 5.

3. "Amgen sets up Hong Kong/China base." Marketletter. 16 Aug 93.

4. "Bayer's Schneider on the competitiveness imperative." Chemical Week. 13 Apr 94, 34-35.

5. Besher, Alexander. The Pacific Rim Almanac. NY: Harper Perennial, 1991.

6. Caponetti, James D. Botany 305. University of Tennessee, Knoxville. 15 Apr 95.

7. "Chinese traditional medicines." Genetic Engineering News. 1 Nov 93, 18.

8. "Copley Pharmaceutical has set up joint venture in People's Republic of China with Chia Tai." Chain Drug Review. 18 Jul 94, RX1.

9. "Copley Pharaceutical to set up joint venture to sell generic pharmaceuticals in China." Med Ad News. Aug 94, 38.

10. Engen, John R. "Getting your Chinese workforce up to speed." International Business. Aug 94, 44-48.

11. Engholm, Christopher. The Asia and Japan Business Information Sourcebook. NY: John Wiley and Sons Inc, 1994.

12. Fouhy, Ken. "China resets its development plans." Chemical Engineering. Jun 95, 44-46.

13. "Gossypol studied as anti-viral agent." International News on Fats, Oils, and Related Materials. May 93, 598.

14. Hallenborg, John. "Supplying bulk actives for the booming generics demand." Chemical Week. 20 Apr 94, 44-46.

15. Huang, Kee Chang. The Pharmacology of Chinese Herbs. Boca Raton: CRC Press, 1993.

16. Launer, John. "East meets West." International Management. Sept 94, 54.

17. Layman, Patricia. "SCI medalist Alex Drauer redeirects Ciba into global competition." Chemical and Engineering News. 6 Mar 95, 15-18.

18. "Low-cost production steers fine chemicals." Chemical Week. 5 Jan 94, 41.

19. "McNeil Consumer Products has introduced wellsource natural decongestant." Lookout Non-Foods Edition. 24 Jun 94, 102NF.

20. Miller, William H. "Hong Kong's future--it's here already." International World. 6 Nov 95, 56-62.

21. Milmo, Sean. "Europe's bulk drugs move offshore." Chemical Marketing Reporter. 26 Sept 94, 9.

22. "Natural product may be Alzheimer's therapeutic." Chemical and Engineering News. 20 Sept 93, 35.

23. "Nypro opens Singapore shop." Plastics News. 27 Nov 95, 3.

24. Pimm, Stuart. Biology 230. University of Tennessee, Knoxville. 27 Feb 96.

26. "Pfizer links with Chinese on herb-based medicinals." Chemical Marketing Reporter. 16 Jan 95, 17.

27. Qinghua, Zhao. "China's CPI: a leader in economic growth." Chemical Engineering. Apr 95, 33.

28. Reier, Sharon. "Elephant walk." Financial World. 28 Feb 95, 38-39.

29. Rohwer, Jim. Asia Rising. NY: Simon & Schuster, 1995.

30. Rotman, David. "Western firms look to tap into China's R & D." Chemical Week. Aug-Sept 95, S10.

31. Todaro, Michael P. Economic Development. NY: Longman, 1994.

32. The Pacific Basin: An Economic Handbook. Euromonitor Public Ltd, 1987.

33. Tremblay, Jean-Francois. "China is becoming silent giant behind Pacific Rim chemical fortunes." Chemical and Engineering News. 11 Dec 95, 53-56.

34. Van Arnum, Patricia. "Pharmaceuticals '95: botanicals blossom." Chemical Marketing Reporter. 18 Sept 95, SR20-SR22.

35. Walden, Gene. "Mending hearts." World Trade. Mar 94, 38-41.

36. Wang, ZT. "Recent advances in pharmacognosy research in China." General Pharmacology. Oct 95, 1211-1224.

37. Wood, Andrew. "BASF sets up vitamin joing venture in Shenyang." Chemical Week. 28 Jun 95, 14.

38. Wood, Andrew. "Overcoming Cultural Barriers." Chemical Week. 5 Oct 94, 36.

39. Worldmark Encyclopedia of the Nations: Asia and Oceania. NY: Gale Research Inc, 1995.

40. Young, Ian. "Rhone-Poulenc moves on four joint ventures in China." Chemical Week. 30 Mar 94, 16.

41. Zhu, YP. "Traditional Chinese herbal medicinals." Pharmaceutical World Science. 28 Jul 95, 103-112.

42. 1995/96 Exporters' Encyclopedia, Dun and Bradstreet Information Services, 1995.