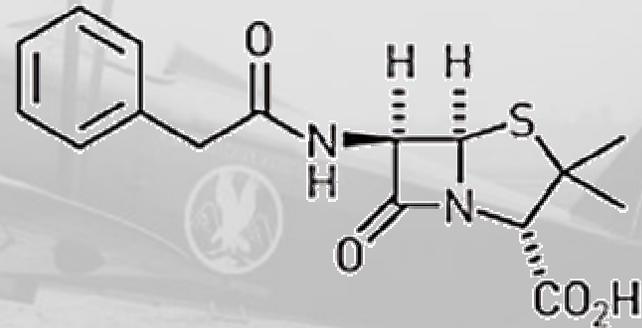
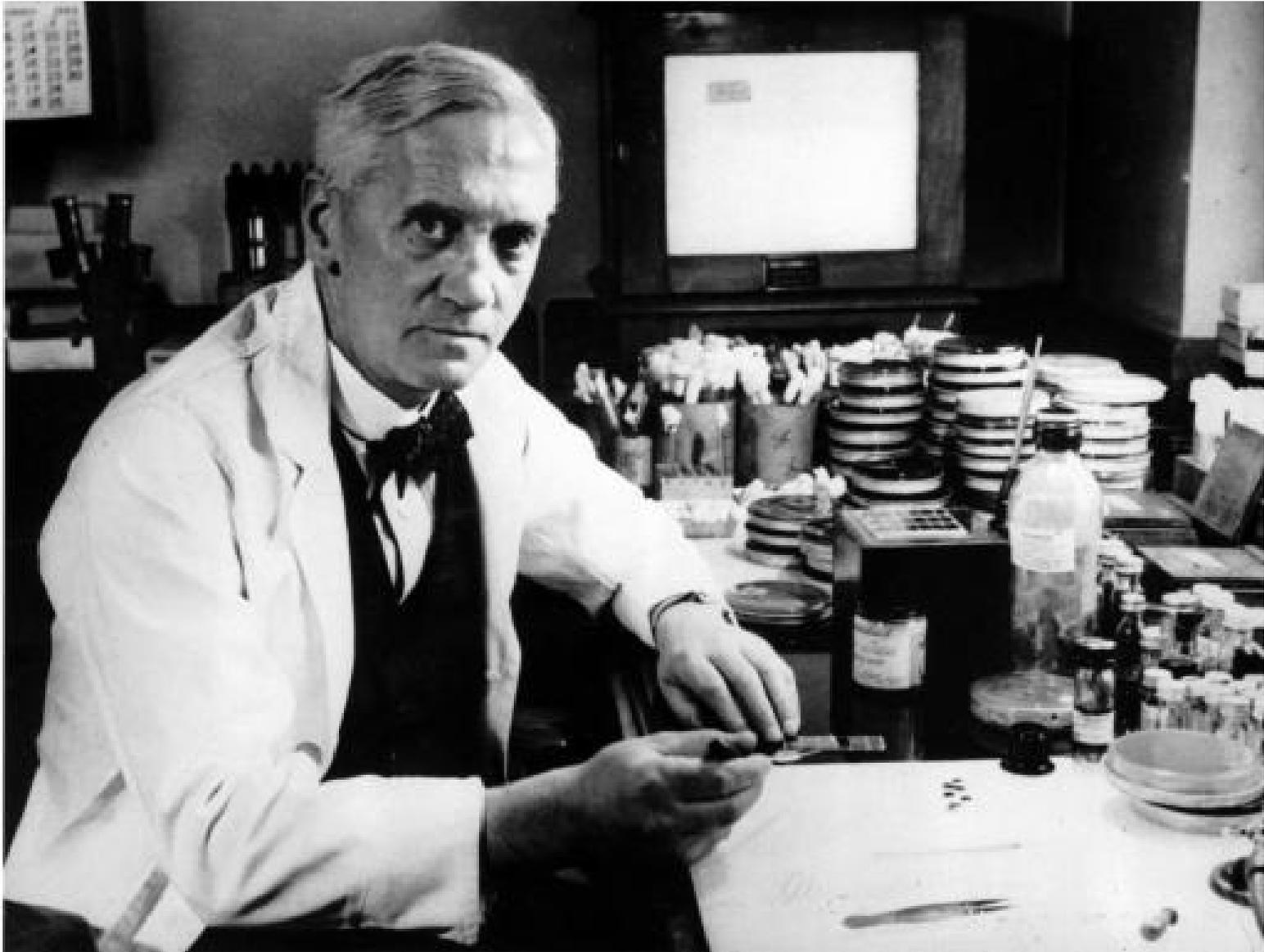


# Penicillin:

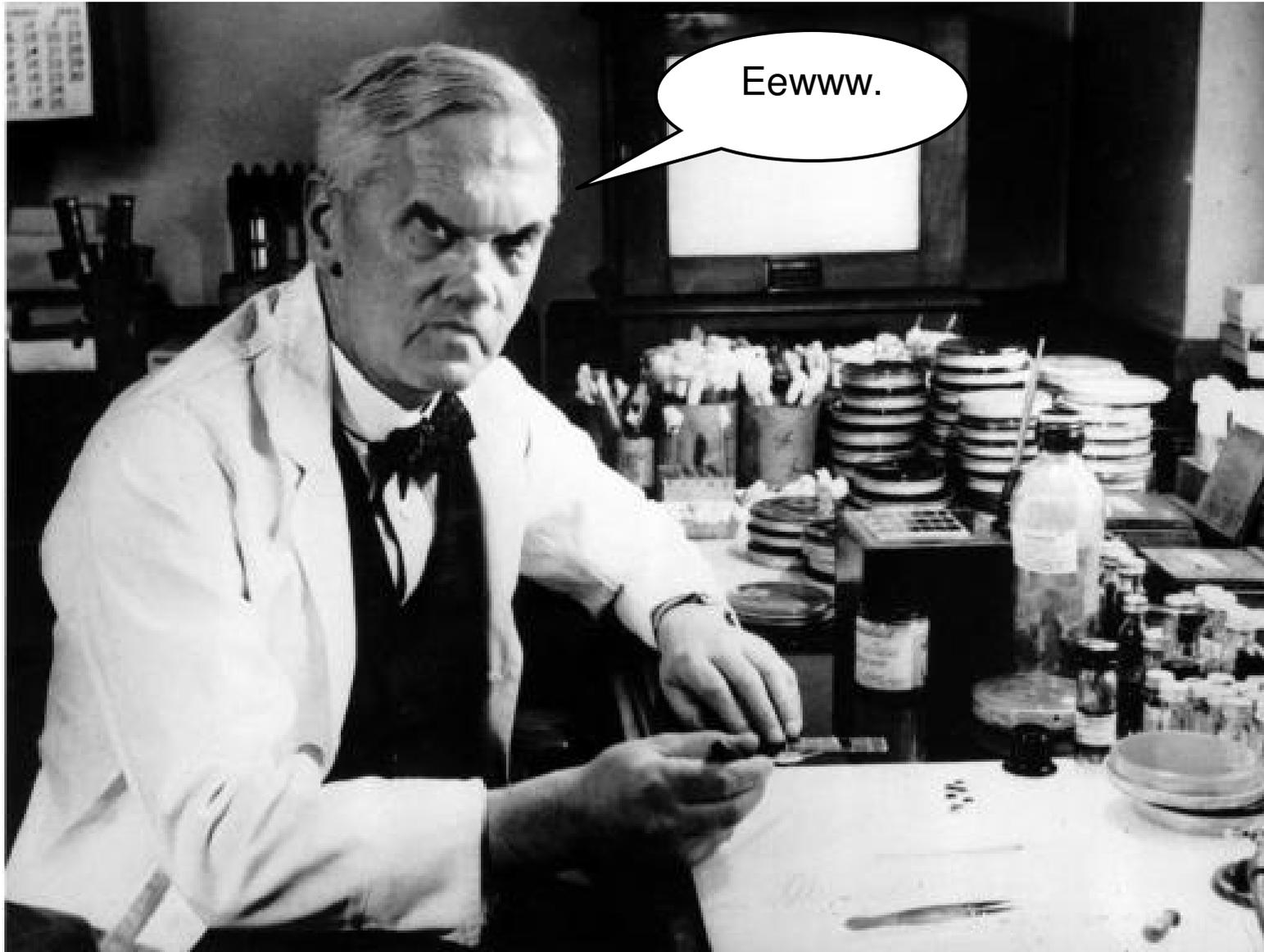
*Lifesaving wonder-drug of the 20<sup>th</sup> century.*



**Penicillin G**



1928: Research scientist Alexander Fleming goes on vacation. He returns to find that his petri dishes have gotten moldy.



1928: Research scientist Alexander Fleming goes on vacation. He returns to find that his petri dishes have gotten moldy.

The bacteria he's trying to grow, *staphylococcus*, won't grow near the mold.

Soon identified as *Penicillium Notatum*, additional tests show this mold is somehow toxic to this and other bacteria.

1928: Alexander Fleming creates a body of work explaining how it works.  
Then... for some reason... stops working on it in 1935.

1938: Fleming's work attracts the attention of Howard Florey and Ernst Chain.

1939: Florey and Chain recognize great value, and begin aggressive research.



Florey



Chain

1942: Anne Miller is very sick. Her doctor, luckily, has professional and personal contacts with Florey. He coaxes a sample of Penicillin from the University of Oxford.

In just 24 hours, Ms. Miller is greatly improved.

Penicillin is hailed as a wonder drug.

There were, however, bigger headlines than  
Ms. Miller could command.

Just a few months before...

A black and white photograph of an industrial facility, possibly a power plant or refinery, with several tall smokestacks emitting thick plumes of dark smoke into the sky. In the foreground, a small boat is on the water, with several people visible on board. The scene is framed by a thick black border.

December  
1941

1942: More military men are dying of infections after injuries than of the injuries themselves.

By June 1944, in preparation for the Invasion of Normandy, The United States Department of War has financed the development of Penicillin and the production of

**100 Billion units per month**  
of the wonder drug.

Post WWII: Penicillin becomes the first commercially-viable antibiotic.

Fleming, Chain and Florey are awarded the Nobel Prize for Medicine.

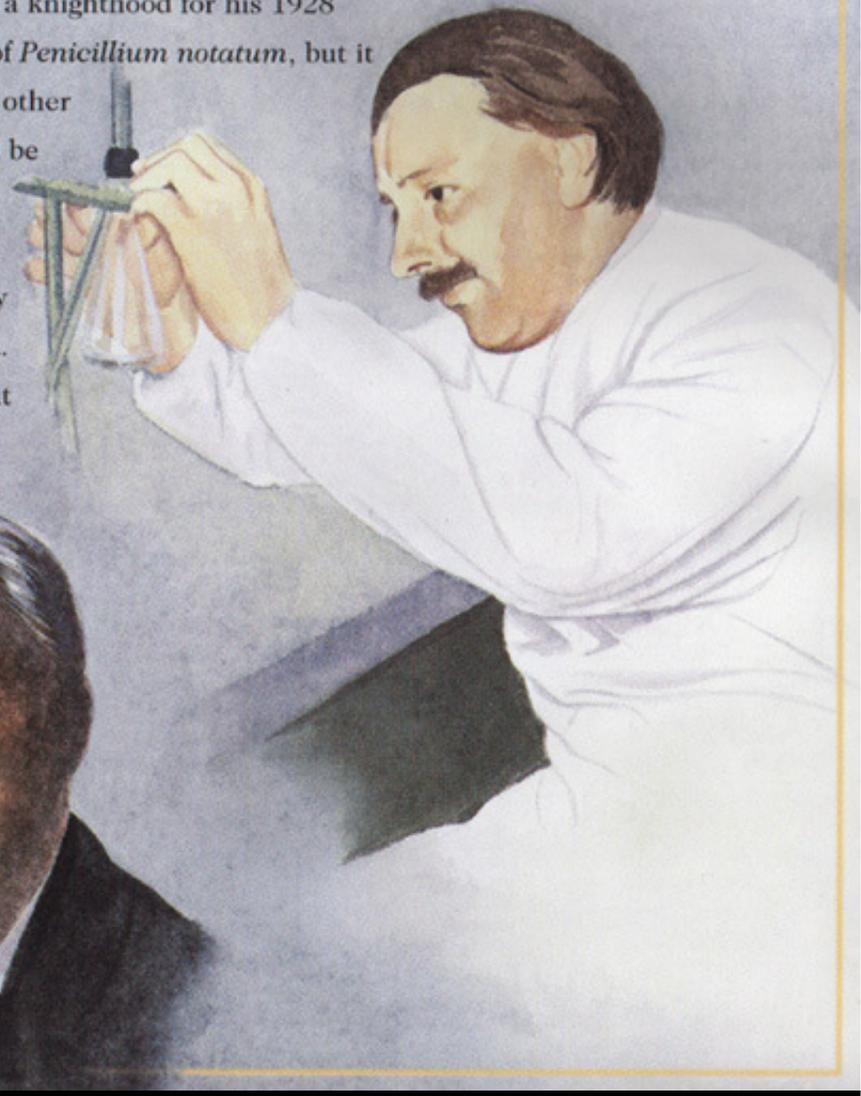
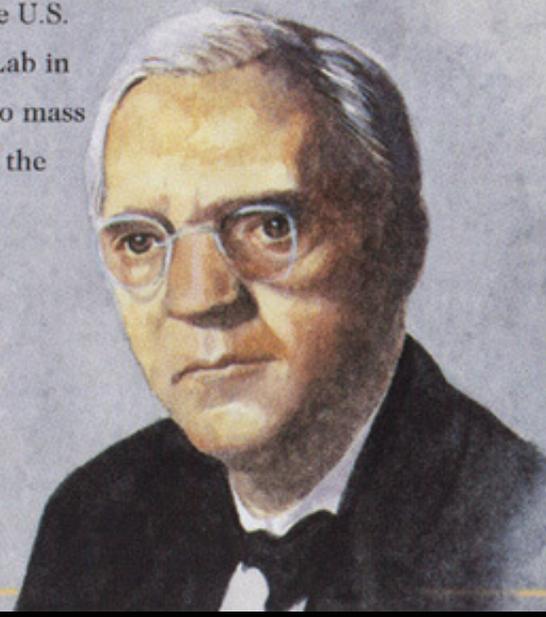
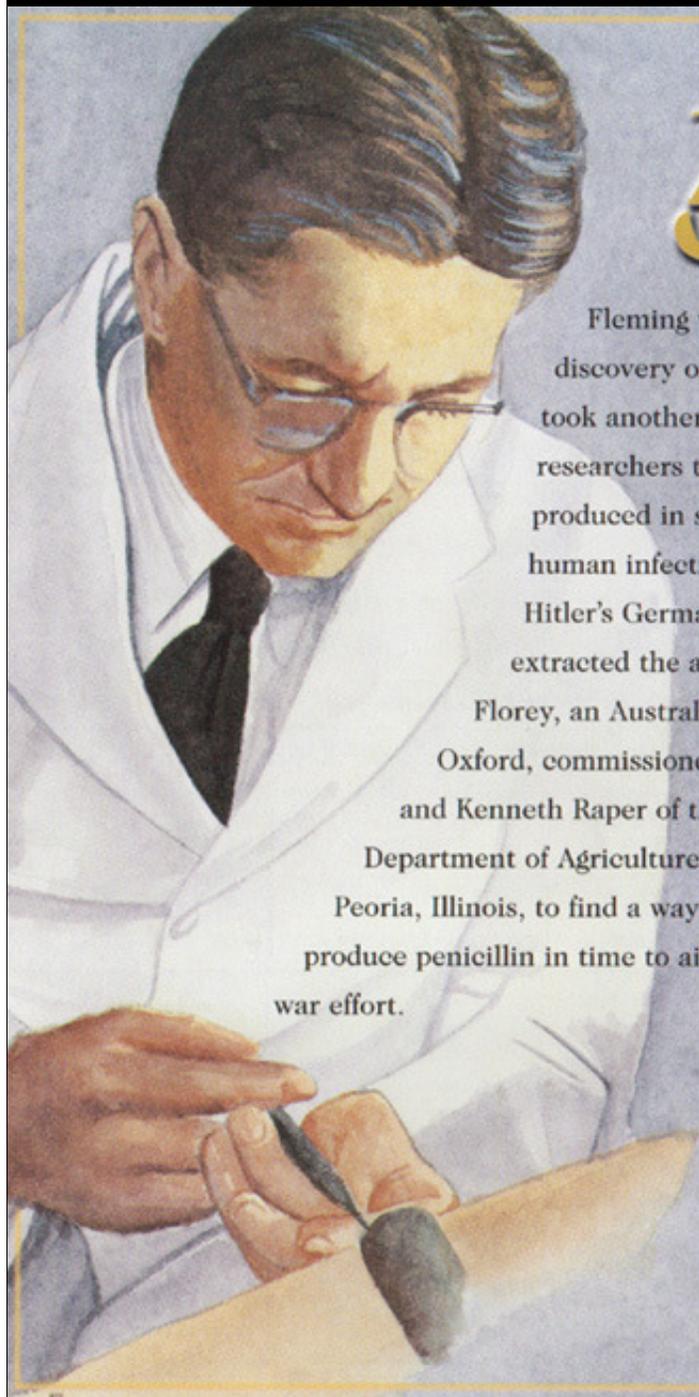
Peacetime production of Penicillin commences.

# 1945 Medicine

Alexander Fleming, Ernst Chain,  
and Howard Florey

Fleming won worldwide acclaim and a knighthood for his 1928 discovery of the bacteria-killing effect of *Penicillium notatum*, but it took another 15 years of effort by many other researchers to produce a drug that could be produced in sufficient quantities to cure human infection. Chain, who had fled Hitler's Germany for England, successfully extracted the active properties of the mold.

Florey, an Australian and chair of pathology at Oxford, commissioned Andrew Moyer and Kenneth Raper of the U.S. Department of Agriculture Lab in Peoria, Illinois, to find a way to mass produce penicillin in time to aid the war effort.





# 1945

## Medicine

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Fleming was a professor and chair of pathology at St. Mary's Hospital in London. Chain was a professor and chair of pathology at the University of Cambridge. Florey was a professor and chair of pathology at the University of Oxford.

Fleming: Knighthood in 1928

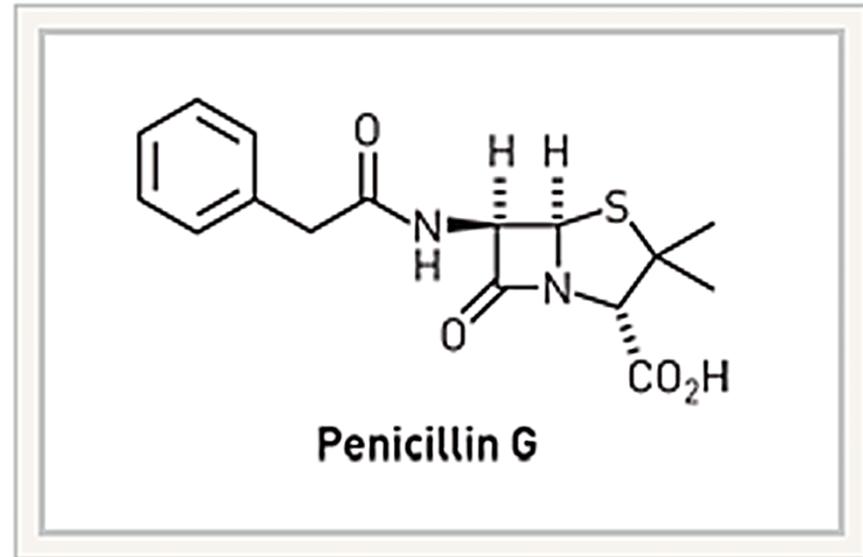
and Kenneth Raper of the U.S. Department of Agriculture Lab in Peoria, Illinois, to find a way to mass produce penicillin in time to aid the war effort.

Chain: Fled Nazi Germany for England

Florey: Australian chairman of pathology at Oxford

How does it work?

Penicillin is a crystalline structure containing a beta-lactam group. The presence of this component kills bacteria by preventing the proper formation of cell walls.



Side effects:

- A significant proportion of the population may be allergic to Penicillin.
- Misuse may lead to resistant super-bugs.
- Other than that, side effects are few and mild.

## Technical information:

### Name:

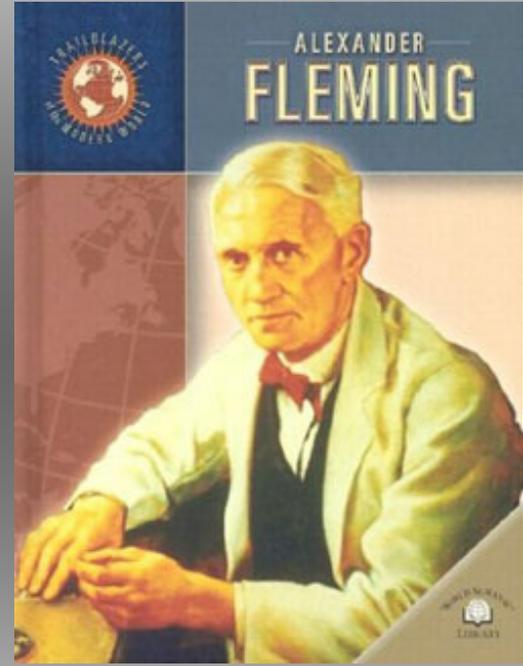
(2S,5R,6R)-3,3-Dimethyl-7-oxo-6-[(phenylacetyl)amino]-4thia-1-axobicyclo[3.2.0]heptane-2-carboxylic acid.

CAS registry: 61-33-6

Commercial success: Sales of Penicillin and other antibiotics are well into the billions of dollars.

Chemical formula and structure: Multiple formulations exist (and have for Penicillin's entire history). The different forms have a common core with different side chains; *2-entenympenicillin* (penicillin F) and *benzylpenicillin*, (G)

Information from **Chemical & Engineering News**, "*Top pharmaceuticals*", June 2005



End