The economic sense of royalty rates.

University's licensing managers are often engaged with the issue of how to determine a reasonable royalty rate for the technology they license. In a previous article in this magazine (*How to successfully negotiate reasonable royalty rate for licensing bioproducts,* George D. Corey and Edward Kahn, Genetic Engineering News, September 1, 1995) the authors argue that the *Industry-standard approach* is the preferable method to determine reasonable royalty rates. According to their experience, Mr. Corey and Mr. Kahn attribute a range of 4%-12% royalty rates to technologies related to therapeutic products.

This article tries to base the reasonable royalty rate on economic sense by utilizing a simple financial model which relates the investment required to develop a therapeutic technology to the income generated by such technology. Mr. Corey and Mr. Kahn refer to this method as *the simple investment theory approach*, but dismiss it as impractical. My analysis shows that using such simple models sheds light on various economic aspects of the reasonable royalty rates that are totally overlooked by the Industry-standard approach.

The financial model used for the following calculations is based on the assumption that a novel early-stage therapeutic technology is licensed by a university to a commercial company. Two scenarios for the investment schedules required for the development of such technology are analyzed in Table 1 and Table 2:

Table 1: Total investment of $100M

Phase	*Duration (Years)*	*Investment (Millions US$)*
Pre-clinical research	2	3
Toxicology and IND submission	1	2
Phase I	1	5
Phase II	2	21
Phase III	3	54
NDA approval and preparation for marketing	1	15
Total	**10**	**100**

Table 2: Total investment of $150M

Phase	*Duration (Years)*	*Investment (Millions US$)*
Pre-clinical research	2	5
Toxicology and IND submission	1	3
Phase I	1	10
Phase II	2	27
Phase III	3	80
NDA approval and preparation for marketing	1	25
Total	**10**	**$150M**

The following additional assumptions were used in the financial model:

1. Sales will increase gradually and will reach full scale 3 years after marketing approval.
2. The total cost of production, marketing, selling etc. (excluding royalty payments) is 80% of sales value. This figure is an estimate based on published data for large pharmaceutical companies.

3. Patents will be issued, on the average, two years after granting the license and will expire after twenty years. Thus, the company will have twelve years of patent-protected sales.
4. The company wishes to receive full return for its investment during the life of the patent (technically this requirement means that there will be no sales after the expiration of the patent).
5. The company's tax rate is assumed to be 35%

Translating these assumptions to a simple financial model enables the calculation of the royalty rate that the company can afford to pay and still be able to achieve the rate of return it requires for its investment. The rate of return is defined as the Internal Rate of Return (IRR) in real terms (meaning that expected inflation rate should be added to the computed IRR in order to calculate the nominal rate of return). Drug development is a high risk venture and such risk should be reflected in the company's required rate of return. The following analysis uses three rates of returns as benchmarks: 15%, 20% and 25%. For each such rate I have calculated the maximal royalty rate, payable to the university, that will enable the company to achieve its desired rate of return. The results of these calculations are shown in Table 3 and Table 4:

Table 3: Maximal royalty rate (total investment $100M)

Sales volume Million $	IRR = 15%	IRR = 20%	IRR = 25%
300	3%	-	-
400	7%	1%	-
500	9%	5%	-
600	11%	7%	2%
700	12%	9%	4%
800	13%	10%	6%
900	14%	11%	8%
1,000	14.5%	12%	9%

Table 4: Maximal royalty rate (total investment $150M)

Sales volume Million $	IRR = 15%	IRR = 20%	IRR = 25%
300	-	-	-
400	-	-	-
500	4%	-	-
600	7%	1%	-
700	9%	4%	-
800	10%	6%	-
900	11%	7%	2%
1,000	12%	8%	4%

Tables 3 and 4 clearly demonstrate that the maximal royalty rate, payable to the university, while ensuring to the company its required rate of return, is increasing with the increase in sales volume. Moreover, this result is robust and does not depend on the assumptions of the model. This point is completely overlooked by the simple industry-standard approach.

Assuming that the total investment required for the development is $100M and the rate of return required by the company is 20% (Table 3), a 1% royalty rate is economically reasonable when the expected sales volume is $400M; however should the sales volume double to $800M the reasonable royalty rate will increase to 10%.

Not surprisingly the required investment for the development of the technology is significant too. Thus, if such investment rises to $150M and the required rate of return remains 20% (Table 4), 1% royalty rate is adequate if expected sales volume is $600M, however an increase in expected sales volume to $800M allows a reasonable royalty rate of 6%.

Another interesting result of this analysis is that the increase in the royalty rate due to increase in sales volume is marginally diminishing. Using our previous example of $100M investment and 20% required rate of return, a rise in sales volume from $400M to $500M increases the

adequate royalty rate from 1% to 5%, while a rise in sales volume from $700M to $800M increases the adequate royalty rate from 9% to 10%.
The figures presented in Tables 3 and 4 show that the range of reasonable royalty rates is wider than the 4%-12% range proposed by Mr. Corey and Mr. Kahn and such rates can vary from 1%-12% (assuming that 20% rate of return is the minimal rate required by the company). These results are consistent with my experience with licensing technologies at early stages; for such technologies royalty rates in the range of 1%-4% is usually acceptable.

The most important insight provided by such analysis is the strong positive relation of royalty rates to sales volume. This point is totally overlooked by the industry-standard approach and according to my experience is usually not taken into consideration. The university usually determines its desired royalty rate by the appeal of the technology (cutting edge technologies deserve higher royalty rate), its proximity to human trials and the extent of the patent coverage. The company usually determines its affordable royalty rate by considering the amount of investment required for the development and the extent of patent coverage. The analysis shown here demonstrates that the expected sales volume is a key determinant of the economically reasonable royalty rates, and thus the factors that determine the expected sales volume such as the potential market, possible competition, the expected product price and the geographically coverage of the patents should be seriously considered while determining such rates.