E

WIPO
WORLD
INTELLECTUAL PROPERTY
ORGANIZATION

CDIP/17/INF/4
ORIGINAL: ENGLISH
DATE: MARCH 14, 2016

Committee on Development and Intellectual Property (CDIP)

Seventeenth Session
Geneva, April 11 to 15, 2016

INTELLECTUAL PROPERTY VALUATION MANUAL FOR ACADEMIC INSTITUTIONS

prepared by Mr. Ashley J. Stevens, D.Phil (Oxon), CLP, RTTP, Lecturer, Strategy & Innovation Department, School of Management, Boston University, Boston, United States of America[1]

1. This document contains an *Intellectual Property Valuation Manual for Academic Institutions*, prepared in the context of the *Project on Innovation and Technology Transfer Support Structure for National Institutions* (CDIP/3/INF/2). The guide has been prepared by *Mr. Ashley J. Stevens, D.Phil (Oxon), CLP, RTTP, Lecturer, Strategy & Innovation Department, School of Management, Boston University, Boston, United States of America*.

2. The CDIP is invited to take note of the information contained in this document.

1 The views expressed in the manual are those of the author, and not necessarily those of the WIPO Secretariat or its Member States

Table of Contents

Table of Tables

Table of Figures

1. Introduction

1.1. Objectives

This Manual is intended to equip technology transfer professionals ("TTP's") with the basic tools that will allow them to ensure that their institution is fairly compensated for the use of its intellectual property ("IP").

The Manual has four specific objectives:

To identify the basic principles of technology valuation;

To describe the terms and techniques TTP's will encounter in the course of their work;

To provide specific tools and resources for valuing specific technologies; and

To look at some examples.

1.2. What Do We Mean By Valuing IP?

Valuing IP, in the context of technology transfer, means identifying the financial terms the TTP will be trying to achieve when (s)he negotiates a license with a potential licensee.

As will become clear in this Manual, there are a number of techniques for valuing IP, and not surprisingly, different techniques will come up with different answers – indeed when these tools are used in a litigation context, as opposed to a negotiation context, valuation experts representing the opposing sides, looking at the same set of facts and using the identical valuation techniques, routinely come up with valuations that are anything from half an order of magnitude to a whole order of magnitude apart.

So, the first insight is that IP valuation is a subjective matter. The results of an IP valuation represent the opinion of one party to a negotiation as to what the financial terms of the license should be.

The TTP will take the results of his/her valuation into the negotiating room and sit down across the table from the TTP representing the potential licensee, who will have done their own valuation exercise and will have their own opinion as to what the value of the technology is, and they will start to negotiate the terms of the license. There will be the usual give and take of negotiations and hopefully at the end of the day the two TTP's will be able to compromise between their two differing valuations of the IP and will reach agreement. At that point they have agreed the ***price*** of the IP. It is no longer an opinion (or, rather, two opinions) about the value of the IP but it has become a commitment that will be captured in a binding legal agreement that will govern the relationship between the two parties over the lifetime of the products that hopefully will result from the licensee's development and use of the IP.

It is critically important that both parties sitting down to negotiate have a basis for their respective valuation. The author still vividly and painfully remembers his very early days as a TTP. A scientist at Dana-Farber had identified a potentially important cell adhesion molecule. Lita Nelsen, the long time director of the OTL at MIT once famously said "A hot academic technology is one that two companies are interested in." Well, this cell adhesion molecule was white hot – ***three*** companies were clamoring for it. With the first of the three companies coming in to start discussions, the author had to be ready with a proposal to make to them. Having no idea what value to put on the technology, he asked everyone he knew in pharmaceutical licensing and academic technology transfer what to ask for. No one could suggest a methodology, so he pulled a big number from the air and put it on the table. When the company asked him what the basis for his proposal was, he had no answer beyond "That's what we think it's worth". The negotiations went nowhere fast.

That experience started my exploration of valuation methodologies that has led to this manual.

The experience also led me to realize that one of the fundamental principles of negotiating theory is to have a bases for your positions.

> If you have bases for your positions, you negotiate those bases and your valuation methodology; that is a rational, manageable negotiation;
>
> If you don't have bases for your positions, you negotiate from emotion; that is an irrational, difficult negotiation.

1.3. What Do We Mean By A Technology Valuation?

A technology valuation is a written analysis of what the negotiator believes the value of a technology to be, and how they derived that valuation, including:

> The methodology that was used; and
> The data that was used in that methodology.

The negotiator has to be prepared to share the analysis with their counterparty in the negotiation and:

> Identify the sources of the data; and
> Discuss the data.

They must also be ready to modify their valuation as the negotiations proceed, based on discussions with the other party. They should be prepared to modify both the valuation methodology used and the data that is used in the methodology.

In the context of negotiating a license, a license valuation means constructing the various financial elements that will make up the final license, i.e., the Term Sheet which is the vehicle by which license agreements are negotiated.

2. The Financial Components Of A License

A license generally contains some or all of the following financial provisions:

Upfront payments;
Ongoing pre-commercial payments;
Patent cost reimbursement;
Milestone payments;
Annual Minimum Royalties;
Research support;
Sublicense income sharing;
Manufacturing;
Earned royalties or sales/profit sharing.

The nest sections discuss each of these payments

2.1. Upfront Payments

Most licenses include some form of upfront payment, variously called a license issue fee, a technology transfer fee, technology access fee, etc.

The upfront payment reflects the value of the technology at the time it is being transferred. For an embryonic academic technology that lacks both market and technology validation, this initial value will be relatively low, and so therefore will be the upfront fee. For a technology that is close to market that the licensor has invested many millions of dollars over several years to develop to that stage, the initial value will be much higher. Typically, the licensor will want to

recoup their investment upfront, in cash. After all, the licensee would presumably have had to spend an equivalent amount to get the technology to that stage, and so should be willing to pay that amount for rights to the technology.

For academic institutions, a key element of the upfront value of the technology is the investment in legal fees that they have put into turning scientific data and publications into an intellectual property portfolio that can be licensed to a corporate partner. Academic institutions normally insist on recouping that investment upfront, in part so that they can redeploy the funds into new inventions that have been disclosed to develop an intellectual property protection round them that can in turn be licensed.

Newly formed start-up companies are usually cash poor. Their share price is typically the lowest it will ever be and so the cash they initially raise is the most expensive it will ever be in terms of the amount of the company they will have to sell to raise a given amount of money. A wise licensor will typically not seek to suck much of that expensive cash out of the company in upfront payments, but will want to see those funds go into developing the technology. Rather, the licensor will generally agree to be compensated in shares of the licensee, purchased at a nominal par value. We will return to this valuation methodology later.

When a large company licenses technology from a smaller, early stage company, the agreement normally includes a purchase of equity in the smaller company by the large one. The price paid for the stock will normally be at a premium to the last price paid for the company's shares, for several reasons:

From the licensor's perspective, the validation of their technology that the license demonstrates means that the company has reached a significant value added milestone;

From the licensee's perspective, in addition to the potential for a financial return if the company's stock increases in price, they are also receiving a strategic value from the

agreement – an opportunity to build their revenues and profits – and so should be prepared to pay a premium to the price paid by investors who were only seeking a financial return

Although most companies accounting rules require that investments in development stage companies that are not yet financially self-sustaining be written down to zero, if the technology is successfully developed, the licensee will likely see an attractive return on their investment. In the early days of the biotechnology industry, Eli Lilly was one of the first large pharmaceutical companies to partner with start-up biotechnology companies, starting with their landmark 1978 deal with Genentech for rights to insulin, and it was widely reported that Lilly more than recouped the license fees they paid in these agreements from the appreciation in the value of the stock in the biotechnology companies they bought as part of the transactions.

2.2. Ongoing Pre-Commercial Payments

Most licenses include a number of "pre-commercial" payments – payments made while the technology is still under development and before it is generating product revenues for the licensee.

2.2.1. Patent Costs

The licensor will normally expect the licensee to pay the ongoing patent costs. The licensee will normally be given the right to determine in which countries patent protection should be sought, and, depending on the relationship between the licensed technology and the licensee's own intellectual property portfolio, may be given the right to either advise on, or to actually control, patent prosecution. If there is considerable overlap between the licensor's and the licensee's patent estates – if say, the licensee owns a composition of matter patent on a drug, and is licensing a patent for a method of treating a new disease using that drug, then the interests of licensor and licensee are opposed – if the licensor's patent doesn't issue, then the licensee will still be free to sell their drug for the new indication, but will not need to pay royalties. In these circumstances, the licensor should keep strict control over the prosecution of their patents, using a

different law firm from that used by the licensee for instance, but allowing the licensee to comment on proposed actions.

2.2.2. Milestone Payments

In academic licenses, milestone payments reflect the increase in the value of the technology to the licensee as the licensee makes progress in developing the technology. It may seem unfair to make the licensee pay additional amounts to the licensor because of the success of the licensee's product development efforts, but this is, in effect, compensation to the licensor for having only received a small payment upfront. Having a low upfront payment benefits the licensee by reducing the licensee's financial risk, because if the technology fails before it gets to the first value added milestone, then the licensee's financial loss will be smaller than if they paid the full value of the technology upfront and then incurred the development costs.

Developmental milestone payments are particularly common with life sciences inventions, because there are well established regulatory pathways that every technology must pass through before the licensee receives marketing approval from the appropriate regulatory authority:

> The pre-clinical/toxicology/ADME/Phase 1/Phase 2/Phase 3/NDA-BLA pathway for drugs;
> The 510(K) or IDE/PMA pathway for devices and diagnostic tests;

The various steps in these regulatory pathways represent both appropriate due diligence milestones and appropriate points to trigger milestone payments.

Other appropriate developmental milestones may include patent issuances in various important jurisdictions:

US

Major European countries (generally, France, Germany, Italy, the UK or Spain)

Japan

Inventions outside of healthcare will generally have less well-defined developmental pathways, and the licensor may need work with the licensee to identify appropriate developmental pathways to which payments can be linked. The challenge is to ensure that there is an unambiguous standard by which to judge whether the milestone has been met. For instance, software and electronics inventions will typically go through a series of trials at customer locations that may variously be described as alpha-testing, beta-testing, etc. However, these phases are not defined legally anywhere and there is considerable overlap between the phases, so if a payment is to be associated with the transition of the product from one phase to the next, licensee and licensor must agree the criteria in unambiguous detail when the license is being negotiated.

For these reasons, a more appropriate mechanism for compensating the licensor for the increasing value of a physical science technology may be through escalating annual minimum royalty payments, which is discussed in the next section.

Milestone payments can continue into the commercialization phase. If there is uncertainty about the sales potential of the anticipated product at the time of licensing, then a milestone payment tied to the product achieving a certain sales volume, either on an annual basis or cumulatively, may be appropriate.

2.2.3. Annual Minimum Royalties

In their simplest form, annual minimum royalty ("AMR") payments are royalty payments that are paid in advance, at the start of the license year. As the year progresses and the licensee sells actual products on which earned royalties are payable to the licensor, the AMR payments are credited against the earned or running royalties, and the licensor doesn't receive any additional

payment until the entire AMR has been credited against the running royalties. For instance, suppose a license specifies an AMR of $100,000 to be paid on January 1 (or more often January 31, to avoid issues of the New Year's holiday). If the licensee is selling $1 million of product per month and owes a 2% running royalty, then the earned royalty payments will be $20,000 per month. At the start of the first quarter, the licensee will send the licensor the $100,000 AMR payment. At the end of the first quarter, the earned royalties due will be $60,000 and will be fully covered by the AMR, so no additional payment will be due, and at the start of the second quarter, a credit of $40,000 will remain. At the end of the quarter, a further $60,000 royalties will have been earned, so after deduction of the $40,000 credit, the licensee will send the licensor a check for $20,000. In the third and fourth quarters there will be no credits remaining, so the licensee will send the licensor a check for $60,000 at the end of each quarter2.

If the parties have agreed that AMR payments will be made before the projected date of product launch, then there will be no earned royalties to offset the AMR. Sometimes such payments are called license maintenance fees or payments, and they are another mechanism to compensate the licensor for the increasing value of the technology, on the theory that if the licensee is still actively developing the technology, then they must see that it still has value.

Such arrangements may be particularly appropriate for non-healthcare technologies to avoid the need to define value-added developmental milestone points at which additional milestone payments will be made.

In addition, an AMR also serves as a due diligence mechanism. If the licensee has lost interest in the technology, either because it doesn't work or because there is no market interest, then the licensee will terminate the license and return the technology to the licensor rather than make an AMR payment.

2 There is normally a 45 or 60 day grace period after the end of a quarter before royalty payments are due to allow the licensee to close their books for that quarter in an orderly way.

AMR payments typically start low and escalate over time. A good rule of thumb is to set the AMR payment after products have entered the market at 10% of projected peak earned royalties. So, if a product is projected to achieve sales of $100 million in its 4th year of sales, and the agreed royalty rate is 5%, so that earned royalties of $5 million will be due, then an AMR of $500,000 per year would be appropriate. In the peak sales year, this figure will be exceeded in the first quarter. In the first year of sales, the AMR may not be exceeded till the end of the second quarter, depending on the rate of market penetration.

2.2.4. Research Support

When a technology is transferred at an early stage, the licensee frequently needs the licensor to help with the development of the technology. This is natural because at the time the license is agreed, the licensor has all the associated know-how and expertise and this will need to be transferred progressively to the licensee. As development progresses, responsibility for more and more of the development will generally shift to the licensee. Frequently, costs increase as development proceeds, with clinical testing, product evaluation, process development, manufacturing, etc.

The costs of this research assistance are paid on an FTE basis, and the licensee should pay the full economic cost. In academic terms, this means they should pay both the full direct and the full indirect costs of the research.

2.2.5. Sublicense Income Sharing

Exclusive licenses always give the licensee the right to sublicense the technology to third parties. Non-exclusive licenses generally don't include such a right, because the licensor can still grant additional licenses to any interested third parties. That said, in some circumstances, however, it may be appropriate to include sublicensing rights with non-exclusive licenses – if, say, the licensee has their own complementary technology, so that allowing the licensee to license the

technology to third parties will allow them to license a complete bundle of technology in a single transaction. In these circumstances, it may be appropriate to limit their right to sublicense to transactions in which they also license their own technology in the same transaction.

The license must therefore include a mechanism by which the licensor receives a portion of the revenues the licensee receives from their sublicensees.

In broad overview, there are two main mechanisms to achieve this:

A "pass through"; and
An "apportionment".

2.2.5.1. Pass Through

A "pass through" is frequently found in licenses where the licensee is a large company. In such licenses, the payment obligations accepted by the licensee are equally binding on any sublicensees. So, a milestone payment may be phrased as:

Upon the first filing of an IND with the FDA or equivalent regulatory agency in countries other than the US, **Licensee or any Sublicensee** shall pay Licensor the sum of fifty thousand dollars ($50,000) within thirty days of such filing.

The definition of "Net Sales" on which royalties will be paid to the licensee will similarly be defined to include sales by the licensee or any sublicensees. The result is that the licensor gets paid the same irrespective of who develops and sells the product.

The philosophy underlying a "pass through" is that the licensor agreed to license the large company in the expectation that the company had all the resources – financial and strategic – to

take the product to market themselves. If the large company elects not to take the product to market for some strategic reason and chooses instead to sublicense the product to someone else to take to market, the licensors' financial return from the license should not be diminished. Equally, however, if the licensee is able to negotiate substantial payments from the sublicensee to compensate them for the value they've added during the time they were developing the technology, then the licensor will receive no part of this.

2.2.5.2. Allocation

Licenses with small companies typically exclude sales by sublicensees from the definition of "Net Sales", so that the licensor only receives running royalties on sales by the licensee:

"Net Sales" shall mean the gross amount billed by Licensee and its Affiliates for Licensed Products and Licensed Processes, less the following:

(a) …….

There will be a separate section on sublicense income sharing which "apportions" all income received by the licensee from sublicensees between the licensor and the licensee. A typical starting point for negotiation would be 25% to the licensor and 75% to the licensee. If sublicenses are entered into soon after the original license was signed (i.e., if the licensee "flips" the technology), the percentage maybe higher than this; conversely, if the licensee has had to put in a substantial investment over many years to develop the technology to the point where it is sublicensable, then a lower percentage may be appropriate.

The reason that this sort of arrangement makes sense is that the licensor entered the deal in the expectation that the licensee would not or could not take the product to market but would do the early stage development of the technology and then either sublicense the technology or do a distribution deal with a large company which would sell products to end users.

The problem is that, at the time the license is entered into, the licensee doesn't know what sort of terms they will be able to achieve in such a sublicense or distribution agreement several years in the future. Suppose the licensee agreed to pay a 6% royalty on their own sales of the product, and agreed to pay the same percentage of sales by sublicensees. If the licensee were only able to negotiate a royalty rate of, say, 10% of sales by their sublicensee and had to pay 6% to the licensor, then the licensee would keep only 4% of the sublicensee's sales, and this would likely be inadequate to compensate them for the investment they'd made in developing the technology.

Therefore the licensor and licensee will agree to split the revenues coming from sublicensees in an agreed proportion. They may agree a single percentage split to cover all income from sublicensees, or they may agree to two percentage splits, one to cover the sharing of payments received prior to commercial sales, and a separate figure to govern sharing of the sublicensee's payment of running royalties on their sales of products. If there are two distribution percentages, the licensor will usually agree to a lower percentage of pre-commercial payments to allow the licensee to use more of such payments to develop the technology, reducing the licensee's need to raise external capital. This will be particularly likely to be the case if the licensor received an ownership stake in the licensee as part of the deal, since the licensor will want to see dilution of their stake minimized.

Often in licenses with start-up companies, the real economic component of the negotiation is that over sublicense income sharing, rather than the running royalty provisions. That said, however, the negotiator should still negotiate hard over the running royalty provisions because if the licensee is eventually acquired by the sublicensee, which is not uncommon, then the sublicense will either become an Affiliate of the licensee or the license will be assigned to the sublicensee, and under either scenario, the sublicensee will pay the running royalties specified in the license to the licensor.

2.2.6. Manufacturing

License agreements frequently include provisions for the licensor to manufacture product for the licensee. This is particularly likely to be true in the early stages of the license when the bulk of the know-how and capabilities reside with the licensor and the licensee is still starting to ramp up their capabilities, but it may well extend on an on-going basis to provide for the licensor to manufacture product for commercial sale by the licensee.

Product manufacturing is rarely an issue for academic institutions, though an academic institution may have pilot scale facilities that can supply modest amounts of product in the early stages of a license.

Manufacture of product is typically done on a cost plus basis. In the biotechnology space, a mark-up of +20% over fully loaded costs is common, with the bulk of the licensor's return coming from the running royalty payments. In physical sciences licenses, if the licensee is going to use, say, a novel material to develop a component that will be used in a more complex finished product, the licensee may agree to sell those products at a price that includes both the cost of manufacture plus a profit to provide a return on the value of the technology in lieu of running royalties.

2.2.7. Royalties On Sales

Royalties on sales, also variously referred to as "running royalties" and "earned royalties", are payments made by the licensee once the licensed products have reached the market place. The licensor generally receives a percentage of the licensee's sales of the licensed products, usually quarterly in arrears. Such post-commercialization payments generally provide the biggest economic return to the licensor from the license if the product is successful.

There are a number of elements of the royalty provisions that need to be negotiated:

The royalty base

The royalty rate

Royalty offsets or deductions

2.2.7.1. The Royalty Base

The royalty base is the measurement of the licensee's sales of the licensed product on which the royalties will be paid. Traditionally the measure has been Net Sales, which are defined as the licensee's invoiced Gross Sales less certain deductions for various costs of the sales transactions that the seller has to incur and that are passed on to the purchaser:

Cash discounts (e.g., many sales arrangements allow the purchaser to take a 1% discount if payment is made within 10 or 30 days);

Sales taxes, tariffs and import duties;

Shipping costs; and

Amounts refunded or credited on returns.

The licensor should resist additional items being included in the list. Two that frequently come up in negotiations are sales commissions and the cost of collecting (or writing off) bad debts. These should be resisted. They are normal costs of doing business and they are within the control of the licensee. The licensor has no control over the licensee's decisions as to whether to grant credit to a particular customer or not, and shouldn't be expected to suffer if the licensee makes a bad credit decision.

It's important to remember that the licensor's only mechanism to verify that they are receiving the correct amount they are owed once products have entered the market will be to audit the licensee. This will involve hiring a CPA to go and visit the licensee and review all the financial records

pertaining to the sales period being verified. The CPA will bill for his/her services by the hour and costs will mount rapidly. It is important therefore to keep the terms of the license simple, so that they can be readily and easily (and therefore cheaply) be verified. One mechanism to do this is by allowing a standard deduction – say 5% -- for all the allowable deductions from Gross Sales to get to Net Sales, e.g.:

"Net Sales" shall mean ninety five percent (95%) of the gross amount billed by Licensee and its Affiliates for Licensed Products and Licensed Processes.

Audit provisions usually require the licensee to pay the costs of the audit if the auditor finds an underpayment of more than 5% in any payment due.

Another issue that needs to be taken into account in determining the royalty base is bundled sales, i.e., if the licensee sells the licensed product in combination with one or more other products which are not covered by the license.

The simplest situation is if all the bundled products are sold separately. In this case, sales of the bundled product will be apportioned in proportion to the price of the products sold separately. For example, suppose a product consisting of a combination of three products is sold for $100 and the licensee also sells all three products separately. The licensee sells Component A, which is the licensed product, for $80, Component B for $40 and Component C for $30, so that the combined price of the three products sold separately is $150. Therefore 66.67% ((100/150)*100) of sales of the combination product would be included in the royalty base in the license for Component A.

If only one or none of the bundled products is sold separately, then sales are frequently prorated on the basis of the cost of manufacturing. However, if the licensed product is cheap to manufacture but contributes a significant proportion of the value proposition of the combination product, use of manufacturing cost may be disadvantageous to the licensor (but not the licensee!)

and it may be appropriate to prorate proportionately – i.e., 50% to each component if the combination product consists of the licensed product and one other component.

These issues must be thought through at the time the license is negotiated – it will be difficult to renegotiate them down the road as products near the market place.

2.2.7.2. The Royalty Rate

The actual royalty rate that is appropriate for a particular technology will be the main focus of the rest of this manual.

There are two ways royalties are calculated:

A royalty based on the dollar value of the product's sales; or
A royalty based on the units of product sold.

A royalty based on sales is expressed as a percentage of the monetary value of product sales, usually Net Sales, as discussed above. Even if the economic basis agreed between the parties for the royalty rate is something other than sales – an increase in profitability or a reduction in manufacturing cost – it is usual to express it in contractual terms as a percentage of sales, both to reduce the opportunities for the licensee to indulge in creative accounting and to reduce the audit costs.

A royalty based on units of product sold will normally be expressed as a fixed amount per unit sold, normally Net Units Sold, i.e., gross units sold less damaged and returned units.

So, suppose a license is for a new manufacturing process, which is projected to reduce the cost of manufacturing a product (its "cost of goods") by 15%, and the licensor and licensee agree that an appropriate compensation is for the licensor to receive 1/3rd of the cost savings, or 5% of the cost of goods, it would be prudent for the licensor and licensee to agree what percentage of the sales

price of the product is accounted for by the cost of goods and to translate the 5% cost savings into a percentage of Net Sales. So, if the gross margin of the product was 70%, so that 30% of the selling price was the cost of goods, then the 5% of the cost of goods would translate to 5% x 30% or 1.5% of Net Sales, and that would be the agreed upon royalty rate.

One of the reasons for avoiding royalty rates in the license agreement expressed in terms of gross or net profits or cost savings is the need to make the license agreement easily interpretable and easily (i.e., cheaply) auditable. Particularly in large, multi-division, multi-product companies the profitability of an individual product will depend on how corporate overhead costs are allocated, and auditing these will be extraordinarily expensive. That said, royalty rates in licenses in the generic drug industry are frequently expressed in terms of gross profits, since the profitability of a generic drug depends critically on the number of participants in the market for that particular drug. Net Profits are generally defined as Net Sales less Manufacturing Costs, so the issue of allocation of corporate overhead is avoided.

Royalty rates can be flat – i.e., there is a single royalty rate that applies to all sales, or tiered – i.e., the royalty rate changes as sales change. Normally, for reasons that will be discussed below, the royalty rate should be higher at higher levels of sales, rather than decreasing as sales increase.

2.2.7.3. Royalty Offsets/Stacking

Licensees frequently negotiate deductions from the royalties otherwise due. These are referred to as “credits”, “offsets” or “royalty stacking” provisions. They can have a significant downward impact on the licensor’s return from the license and frequently take up a significant proportion of the time devoted to financial matters in the negotiation of the license.

The current year’s Annual Minimum Royalties will clearly be creditable against the earned royalties due. The licensee may ask for credits for prior years’ Annual Minimum Royalties that were not used (either because sales were too low to generate sufficient earned royalties to utilize

all the available credit or because it was anticipated that the product wouldn't be in the market yet, so the AMR was effectively a license maintenance payment). This should be rejected.

Licenses signed in the 1980's frequently allowed patent costs to be deducted from earned royalties. This is not done currently and should be rejected if proposed.

The most difficult area concerns offsets for royalties owed to third parties for other technologies needed to be able to make use and sell the licensed products.

Until 2001, US patent applications were secret until they issued. A licensee of a particular technology therefore could not know what other patents might issue that they would need a license to in order to be able to practice the technology they were licensing, and hence no idea of what additional royalties they might have to pay, so stacking provisions were legitimate and prudent from a business perspective.

A common arrangement for offsets is to allow a deduction of 50% of the royalties payable to a third party, but for the total of all such offsets not to reduce the agreed royalty rate by more than 50%. This forces the licensee to negotiate hard to minimize third party royalties. If a one-for-one deduction were permitted, the licensee wouldn't care what rate they agreed to pay a third party– they could deduct it all from the royalties they had to pay under the primary license.

So, suppose the royalty rate in the primary license is 6% and the licensee has to pay royalties of 2% and 1% for two other technologies. They would be able to deduct respectively 1% and 0.5% of these royalties from the primary license and would therefore pay a 4.5% royalty to the licensor. The licensee's total royalty obligations on the product (frequently referred to as the "total royalty burden") would be 4.5%+2%+1% or 7.5%

But suppose the royalty rate in the primary license is 5%, and they have to pay royalty rates of 3%, 2% and 2% for three other technologies. The potential deductions from these would be 1.5%, 1% and 1% respectively, totaling 3.5%. However, the maximum allowable deduction is

50% of 5% or 2.5%. Therefore the licensee would pay 2.5% to the licensor of the primary technology and 7% in total to the licensees of the additional technologies, so that the total royalty burden on the product would be 9.5%.

An important concept in stacking provisions that the parties must clarify at the beginning of the negotiations is whether the stacking applies to any third party royalties the licensee has to pay in order to make use and sell the licensed product or just to any licenses the licensee has to take in order to practice the licensed technology, i.e., if a third party has a blocking patent that impacts the practice of the licensor's technology.

The "American Inventors Protection Act of 1999" (P.L. 106-113), signed into law on November 29, 1999, required US patent applications to be published 18 months after their initial filing, bringing the US more in line with most international patent systems. Starting in March 2001, US patent applications have been published, together with the file wrapper showing how prosecution is proceeding and giving third parties insights into what claims are likely to issue. The only exception is if the inventors certified that they were not going to seek international protection; in these circumstances they could withhold their application from publication until the patent ultimately issued. This substantially reduces the potential for licensees to be "blindsided" by an unexpected blocking patent that they have to license. It is therefore reasonable to require the licensee to identify the licenses they will need to be able to practice the technology and only allow offsets for technologies that couldn't have been identified at the time of license – those that had been filed in the past 18 months and hence had not yet been published, and those that were not filed internationally and hence were not published in the US. Obviously, in major territories outside the US, such as Europe, Japan, Canada, Australia, etc., all patent applications are published, simplifying negotiations over offsets.

Multiple licenses are frequently required in the biotechnology industry, where there are numerous platform technologies needed to develop and manufacture protein-based therapeutics, particularly antibody products. Total royalty burdens of 15-20% are not uncommon in this industry, dwarfing all other costs of production of the products. Platform technologies tend to be the earliest

discoveries in a particular field of biotechnology and hence to expire relatively early. The core Cohen-Boyer patent on the basic techniques of recombinant DNA, which was licensed for a 1% royalty, expired in December 1997 and had accrued $255 million in royalties through the end of 2001. Owing to a protracted interference proceeding, the patents underlying production of therapeutic monoclonal antibodies, the Cabilly patents, first filed in 1983, won't expire till December 2018, and these patents have yielded hundreds of millions of dollars for Genentech and the City of Hope Hospital.

One negotiating approach that has worked for the author is to negotiate a relatively low royalty rate, but to require that it (a) be non-offsetable and (b) be passed through to sublicensees. This approach can eliminate two of the most contentious areas of financial negotiation – offsets and sublicense income sharing – accelerating the negotiation process, and probably netting the licensor the same financial return. The author has found 3% for life sciences inventions to be an appropriate royalty rate if this approach is to be used.

2.2.8. Profit Splits

In some cases, the parties may agree to split the profits from the sale of the licensed products rather than provide a royalty "off the top". Profit splits are often encountered in licenses by biotechnology companies of late stage products to pharmaceutical companies.

Because of the number of expenses a company incurs that need to be charged to different products, profit sharing license agreements require a considerably more detailed set of financial provisions to identify what costs are allowable so that the licensor will be able to audit the payments they eventually receive. Profit sharing arrangements work best if the licensee sells a relatively small number of products, so that cost allocations are fairly clear and transparent. This is one reason why they work well in the pharmaceutical industry.

Outside of the pharmaceutical industry, it is safest to limit royalties based on profit sharing to the company's total profits from all products, rather than its profits on a particular product, product

line or division, because of the ability to shift cost allocations between different products, product lines or divisions.

This will only be acceptable to the licensee from a business perspective if the license is to a platform technology on which all the company's products will be based. Even then, the company will eventually diversify and develop products that are not based on the licensed technology and tensions will arise.

3. The Financial Return From A Hypothetical License

Suppose the terms of a hypothetical life sciences license are:

License issue fee	$1 million
Annual minimum royalties	
Years 2-4	$100k/year
Years 3-7	$300k/year
Thereafter	$500k/year
Milestone payments	
Enter Phase 1 (Year 2)	$250k
Enter Phase 2 (Year 3)	$500k
Enter Phase 3 (Year 4)	$2.5 million
NDA Approval (Year 6)	$5 million
Cum. Sales $100 mill (Year 7)	$5 million
Royalty rate	3.84%
Sunk patent costs	$300k
Annual patent costs	$100-$300k/year

and suppose the Net Sales of Licensed Products are:

Year	Product Sales
7	$100 million
8	$200 million
9	$400 million
10	$600 million
11	$800 million
12	$1,000 million
13	$1,050 million
14	$1,010 million
15	$1,050 million
16	$1,000 million
17	$900 million
18	$800 million
19	$700 million
20	$600 million

Figure 1 shows the financial flows to the licensor from the license.

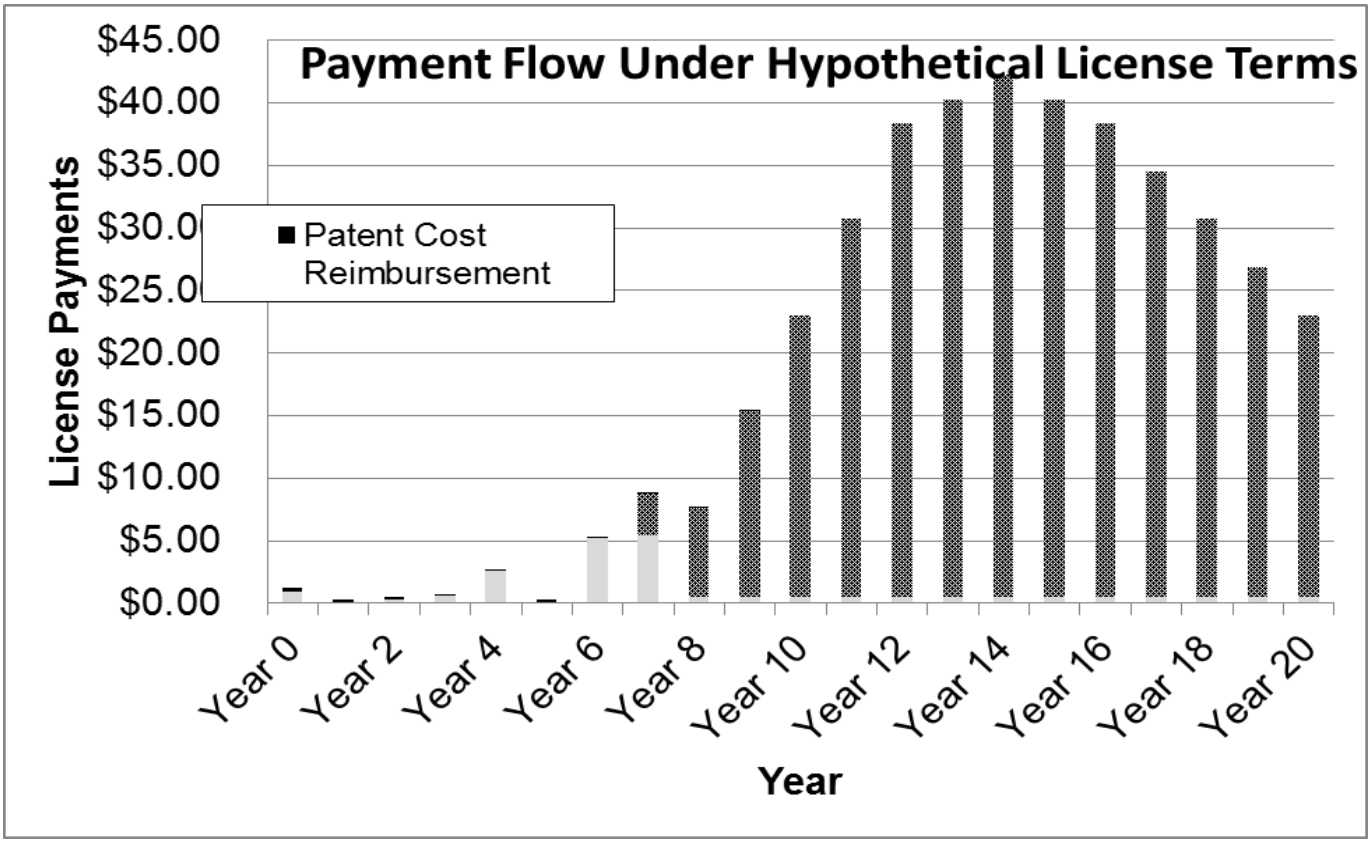


Figure 1 shows that the income from earned royalties on product sales of a successful product dwarves all other payments, with the exception of the last two milestone payments.

This illustrates where the primary focus in negotiations must be – late stage milestone payments and earned royalty payments, i.e., payments that are predicated on the product development effort being successful.

4. Principles Of Valuation Of IP And Intangible Assets

4.1. Introduction

Traditionally the market for IP was relatively illiquid. IP is created as a result of research and if the creating organization was a public research organization, it generally sought to license the IP to someone else for commercialization. If the creating organization was a commercial entity, it generally retained the IP within the organization and either used it in its products or put it on the shelf and left it there. The next time the IP saw the light of day was if another organization infringed the IP and litigation ensued.

There were therefore two basic contexts in which IP was valued:

Litigation
Licensing

Litigation has a much greater near term economic impact, with damages sometimes running into the hundreds of millions or even billions of dollars, and not surprisingly litigation was where valuation methodologies were developed to calculate damages that would be sought to compensate the owner of the infringed IP for its illegal use.

By contrast, the first textbook on valuation in licensing, Richard Razgaitis' "Valuation in Licensing" was not published until 1999.

However, the circumstances and context of valuation in litigation are totally inapplicable to the circumstances and context of licensing:

Short of war, litigation is possibly the ultimate adversarial activity. There will be a winner and a loser, and, after appeals are exhausted, the outcome achieved by the winner will be imposed on the loser with the full force of the law.

Licensing by contrast is a collaborative activity entered into by dealmakers. The outcome they reach must be a win-win situation for both, otherwise the licensee, the party at risk for future investment, will walk away from the license.

Intellectual property litigation is an enormously expensive proposition. The 2011 AIPLA Annual Survey of the cost of intellectual property litigation reported a mean cost through trial of $6 million for major patent litigation cases (when $25 million or more was being sought in damages). In other words, in over half of litigations, costs exceeded $6 million. And after trial, the losing side will inevitably appeal. Therefore, parties only litigate when they have the possibility of winning substantial damages, which will only be after a substantial market has developed for the infringing products. In other words, valuation in litigation is done retrospectively.

By contrast, licensing is done prospectively – before a product is sold and frequently before it's even clear whether the technology will work. There is no information available on the sales or profitability of any products.

Litigators have an incredibly powerful tool on their side – DISCOVERY. In litigation, each side requests – and receives – every conceivable piece of information it can think of that the other side might possess that could possibly help bolster its case.

Licensing by contrast is characterized by immense information asymmetries. The licensor generally knows the most about the technology at the time of the negotiations. The licensee will perform due diligence – request and pore over all the data, ask all the questions and perform confirmatory experiments itself – but will probably not identify all the points of weakness in the technology. On the other hand, the licensee knows more about their plans for the technology and its economic potential, and is under no obligation to share that information with the licensor.

Finally, in litigation, the value of the technology is established at a point in time and transferred in a single payment. On March 3, 2006, Research In Motion paid NTP $612.5 million in order to

avoid Judge Spenser issuing an injunction that would have forced RIM to cease selling its Blackberry line of smartphones.

By contrast license agreements rarely pay the full value of the technology upfront – the uncertainty of technology and market success is so high that any such upfront program that a licensee would be willing to pay will be so heavily discounted that such a transaction is unlikely to be attractive to the licensor. Parties negotiating a license agreement instead strive to set up a mechanism that fairly shares the fruits of success between licensor and licensee. For instance, in 1966 the University of Florida's Robert Cade, the inventor of Gatorade®, offered to license the Gatorade formula and trademark to Stokely Van Camp for $1 million fully paid up, an enormous sum in 1966. Stokely Van Camp, facing a $1 million test market to find out whether anyone would buy this totally novel beverage, declined the offer and offered to pay royalties on sales. To date (being a trademark license, payments continue indefinitely), Stokely Van Camp and the various successor companies that bought Stokeley Van Camp have paid approaching $1 billion to the Gatorade Trust that owns the core intellectual property.

4.2. Who Needs To Value IP?

There are many circumstances when technology needs to be valued. Indeed IP valuation is an on-going process that will be repeated throughout a technology's lifecycle as new information becomes available:

Willing Sellers The institutions that are selling or out-licensing technology, such as academic institutions, national laboratories and start-up companies;
Willing Buyers The organizations that are acquiring or in-licensing technologies from the Willing Sellers, such as start-ups and larger established companies
Investors Organizations investing in technology development, such as venture capitalists, investment bankers and corporate R&D managers,
Lenders Organizations looking to secure loans with intellectual property;
Acquirers Organizations such as investment bankers looking to fund acquisition of companies whose intellectual property constitutes a significant part of their value (e.g., Google's $12.5 billion acquisition of Motorola Mobility, where Motorola's IP was estimated to be worth half of the total price Google paid);
Monetizers Organizations seeking to acquire royalty streams;
Unwilling Buyers and Sellers Companies being forced to take licenses as a result of litigation.

Many organizations have both in-licensing and out-licensing functions, with the relative importance reflecting the company's business model. For instance, biotechnology companies live and die by the deals they do with large pharmaceutical companies, and the Business Development group that does the out-licensing deals is much more important to the company's success than the

in-licensing group that acquires technologies, usually from academic institutions. In large pharmaceutical companies the position is reversed; increasingly they live and die by the late stage drugs they're able to acquire rights to and the terms they have to pay, so the in-licensing group is the more important and the out-licensing group is limited to disposing of assets the company has decided not to pursue and to licensing platform technologies non-exclusively.

4.3. The Factors Affecting Technology Valuation

4.3.1. Scope Of The License

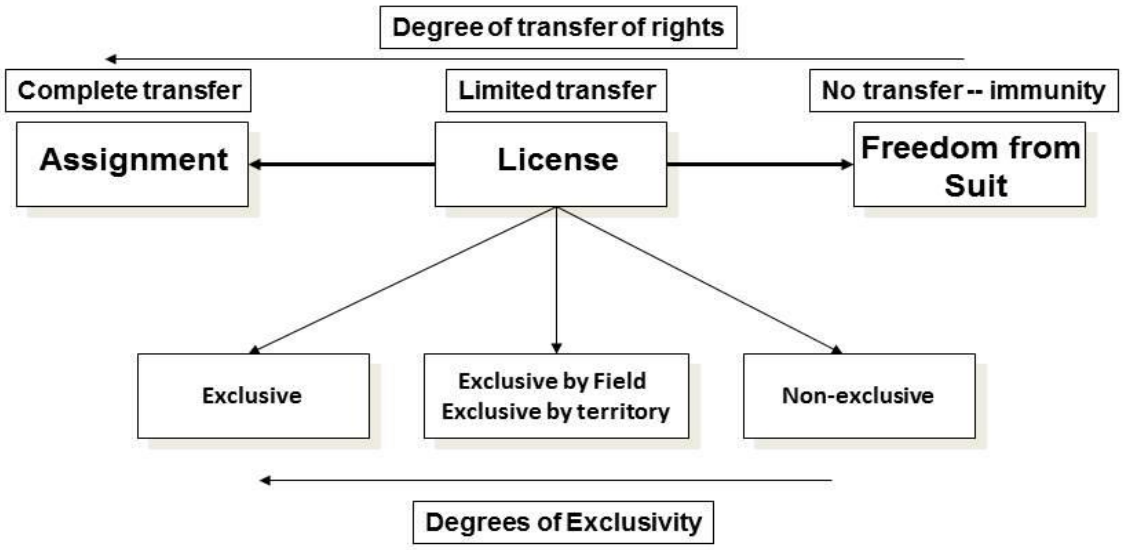
As a general proposition, the more that is included in a license, the higher its value. Some of the variables are:

Scope of license:
A broad array of rights to a technology can be granted in an IP transaction, ranging all the way from an assignment, in which the owner transfers their complete right, title and interest to the new owner, to a freedom from suit or covenant not to sue, in which the owner grants no specific rights to the technology to the third party but promises not to sue them for infringement.

In between these two extremes are all the various nuances of a license, in which the owner of the IP retains ownership of the IP but grants rights to use it to one or more third parties. The extent of the rights granted can range from an exclusive license even to the complete exclusion of the IP owner, through an exclusive license where the IP owner continues to have some rights to the technology, through a defined number of co-exclusive licensees to an unlimited number of non-exclusive licensees. Rights can be further subdivided by field of use and by geographic territory. This is illustrated in

Figure 1.

Figure 1 Degrees Of Rights Transferred In An IP Transaction



4.3.2. Other Facotrs Affecting The Value Of A Patent

How strong are the patents?
-- How easily are they avoided or engineered round

- What other technology rights are included?
  -- Background IP rights that are needed to practice the technology
  -- Rights to improvements that the IP owner comes up with in their continuing work on the technology
  -- A working prototype
  -- *In vivo* animal or human clinical data

Characteristics of the patent
-- What does the patent protect?

In general, the order of value of patents is:

- Composition of matter (pharmaceuticals)
- Apparatus (materials)
- Composition of matter (materials)
- Method of use
- Manufacturing process
- Formulation

-- Does it protect characteristics perceived to be of value by consumers, or is it something that is necessary to make a product work but is largely invisible to the user of that product?

-- How broadly does it exclude others? (i.e., how easily is it avoided?)

4.3.3. Risk

Product development is an inherently risky process. A review3 of product commercialization success rates gives success rates varying from the 1997 figure from Stevens and Burley (no relation!) of 1 in 3,000 raw ideas being a commercial success (defined as returning a greater amount to the company than was invested in creating the product) 4 to a 2004 study by the Product Development and Management Association (PDMA) which showed that 24% of new ideas reach the commercialization stage and 14% of new ideas result in a commercial success5. Some of the risk factors are:

• R&D risk	the risk that the technology can't be successfully developed into a functional product
• FDA risk	the risk that the product won't be found safe and effective; a recent study6 showed that only 9% of drugs that enter Phase 1 receive FDA approval
• Standards risk	the risk that a standards setting body will adopt a standard that is incompatible with your product

3 http://www.rti.org/newsletters/cta/newsletter.cfm?issue=v4n4Dec07&article=v4n4Dec07SpotlightLessonsLearned

4 Stevens, G. and J. Burley, "3,000 Raw Ideas = 1 Commercial Success!" Research-Technology Management, May–June 1997.

5 Adams, M. and PDMA Foundation, "Comparative Performance Assessment Study 2004," available for purchase at www.pdma.org

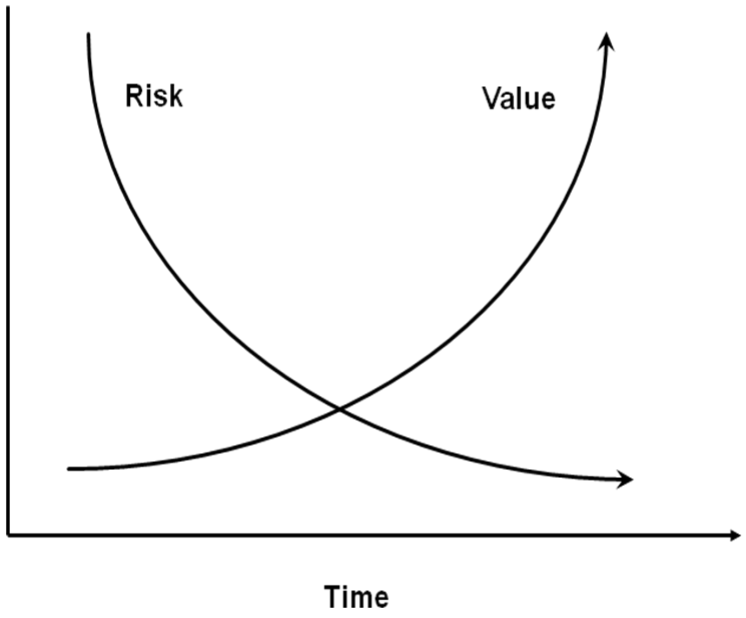
6 http://www.biotech-now.org/wp-content/uploads/2011/02/bio-ceo-biomedtracker-bio-study-handout-final-2-15-2011.pdf

- Manufacturability risk — the risk that the product can't be manufactured at an acceptable cost
- Marketing risk — the risk that the marketing launch of the product is unsuccessful
- Competitive risk — the risk that a competitor using a different technical approach solves the same problem as you and reaches the market first
- Legal risk — the risk that a competitor receives a patent that blocks you from entering the market and isn't willing to grant a license. As discussed in §2.2.7.3 above, this risk has decreased substantially since 2001, when US patent applications started to be published 18 months after filing as is the practice elsewhere in the world. Prior to this there was no way to know what patent applications were being prosecuted.

Risk and value are inversely related – the higher something's risk, the lower its value. Therefore a technology has its lowest value at its inception before any of the market and technology risks have been eliminated as the technology moves through the product development process, as shown in

Figure 2.

Figure 2: Relationship Between Risk And Value



This graph (and the Gatorade® example discussed above) explain why licensors of early stage technologies rarely agree to fully paid-up licenses – i.e., where the licensee pays all the fees upfront. Such payments will be made at the earliest, highest risk stage in the product's lifecycle and so will be very highly discounted to account for this high risk.

5. Valuation Methodologies

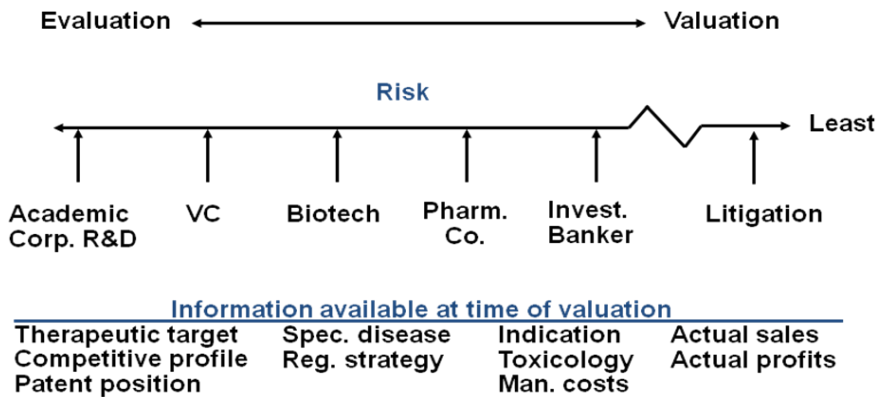
5.1. Changing Valuation Methodologies Over Time

The information that is available about a technology changes as it is developed, as illustrated in Figure 3 below.

At the earliest stages, very little quantitative information will be available, and valuations will be largely qualitative and will have to make broad assumptions about expected performance. As the technology is developed, more information, on both the technical and market aspects will become available and valuations will become increasingly quantitative and rigorous. Finally, valuations

done in litigation after a product has entered commercialization will be able to draw on actual sales and profitability.

Figure 3: Information Available As A Life-Sciences Invention Is Developed



5.2. Quantitative Valuation Methods

5.2.1. Overview

Economists teach us that there are only three ways to value any asset:

Cost

Market

Income

In any given situation, one of these methods will be superior to another.

Consider a valuation exercise which most people have to carry out at some point in their lives – deciding how to set the price of a house they want to sell.

Houses last a long time, and building costs and the cost of land generally only rise over time. Therefore, the cost to build a house, generally speaking, will have no relevance to the price someone will agree to sell it for many (or even a few) years after it was built. Instead, someone will look to market forces to set a price – they ask the question: "What have houses of similar size – the number of bedrooms, bathrooms and living rooms – nearby in the same community and of comparable quality sold for recently?" Since real estate transactions are recorded publicly, such comparable data is readily available in most countries. Indeed, the advent of the internet and of websites such as Zillow.com have resulted in daily price estimates being available on every house in the U.S.

However, suppose you have very recently bought a house in a new development where new houses are still being built and sold, and your employer unexpectedly promotes you but transfers you to a new city and you have to turn around and resell your house. Now, suddenly, the cost to originally build your house becomes very relevant, because that is the price at which the developer will be selling brand new houses and that will set a cap on what you can price your house at. Indeed, unless you've made some improvements to your house, you may have to sell it at a modest discount to the builder's price for a new house to allow for the wear and tear your occupancy has put on the property since the builder turned it over to you in pristine condition.

Or suppose you own a multi-family house and occupy one unit and rent out the other three units. It's very likely that the potential buyers for the house will be investors who intend to rent out all four units rather than living in one, and the price they will be prepared to pay will be determined by the income they can generate from renting the units less their costs to own and maintain the building, a very different analysis from the market comparable approach.

So even in the seemingly simple valuation context of pricing a house, different valuation methodologies will be appropriate in different commercial situations.

5.2.2. Intellectual Property Valuation Methods

These same broad considerations apply to valuing intellectual property and a number of different approaches have been developed to apply them, as shown in Table 1, where I classify them into the three basic approaches of the economists.

Table 1: Technology Valuation Methodologies

Economist's Approach	Licensing Approach
Cost	Cost
Market	Industry norms and standards Comparables Ranking/Rating Auction Equity
Income	Rules of Thumb Net Present Value Risk Adjusted Net Present Value Monte Carlo

5.3. List Price Valuation

We start with an alternative to carrying out a specific valuation exercise for a technology at all – what I call "List Price Valuation".

A number of institutions are adopting standardized, streamlined approaches to licensing their technologies. The approach started with the University of North Carolina Chapel Hill, which implemented an approach called the Express License in 2009 for spin-out companies wanting to license UNC technologies. The standard form of the license agreement can be found at: otd.unc.edu/documents/CarolinaExpressLicenseAgreement2. 02011.pdf

The agreement is non-negotiable, apart from agreeing due diligence milestones that are appropriate for the specific technology. To get companies to agree to accept the license "as is", the financial terms are highly attractive:

1% royalty on products requiring FDA approval based upon human clinical trials;

2% royalty on all other products;

Cash payout to the University in the event of a merger, stock sale, asset sale or IPO of 0.75% of the company's fair market value;

One year holiday on patent costs incurred upto one year after the license date

A year later, the University of Glasgow went a step further and adopted an Easy Access IP policy, in which the majority (around 90%) of its technologies would be made available to Glasgow-based start-up companies at no charge. The companies have 3 years to demonstrate success, and must acknowledge the university as the source of the IP.

A number of other universities, including Kings College London, Bristol University, the University of New South Wales and the University of Ottawa have adopted Easy Access.

A number of universities have started offering fully paid up licenses to IP created in the course of sponsored research agreements. In 2011, the University of Minnesota created a program called the Minnesota Innovation Partnerships under which they offer fully paid up licenses if the sponsor of the research pays the university's full indirect cost rate and pays an additional $15,000 license fee (or 10% of the research contract if less). A 1% royalty on sales kicks in if product sales exceed $20 million annually.

The University of Iowa and Iowa State Universities have also adopted this approach, while Penn State University is adopting a policy under which they will allow companies who sponsor research at Penn State to own any IP that is generated in the research.

5.4. Cost-Based Valuation

5.4.1. Description

The concept of using sunk costs to value a technology is that the developer wants to first recoup their investment in developing the technology and then secure a return on that investment.

The problem with this approach is the fundamental philosophical question of whether the cost to develop a technology is relevant to its on-going value. Ask yourself this question: "Would you want to or be able to sell a used lottery ticket for what you paid for it?" After all, if the lottery ticket is a winning ticket, then you would only sell it for much more than you paid for it, and if it's a losing lottery ticket its value is only the scrap value of the cardboard or paper it's printed on. [Not, of course that we would want in anyway to imply that technology development and licensing is a lottery!]

One of the objections that a licensee will raise to a cost based valuation by an academic institution is "This technology didn't cost you anything to develop – it was developed with a **GRANT**." To which the licensing professional should respond: "Yes it was. And the granting agency expects us to secure a fair return on the investment they've made in the technology."

That said, there are several areas where cost is front and center in license negotiations:

As discussed above, academic institutions always seek to recoup the discretionary investment they have made in securing patent rights in the license agreement. Such costs are identified separately from any other up-front cost, and may be substantial if the technology has been under development for an extended period.

Another way cost can be used constructively is if two collaborators are unable to agree on how they should share the economic return from the collaboration. The amount each has invested in the collaboration would be an equitable basis for determining the relative ownership in the outcome.

In licensing copyright-protected software developed in an academic setting, recouping the sunk cost may be infeasible. A company interested in using the software could instead simply hire the researcher who wrote the code and get them to recreate it. It will take them much less time to write the code the second time round, so valuation should be based on the Modified Replacement Cost method , in which the cost to repeat the work, typically 60% of the original cost, is used.

In corporate licensing transactions, where the licensor has made a substantial investment in developing the technology, they will want to ensure that they recoup that investment in upfront and milestone payments.

5.4.2. Dynamics Of A Cost-Based Negotiation

Because a cost-based valuation is divorced from the value of the technology, negotiations are inefficient.

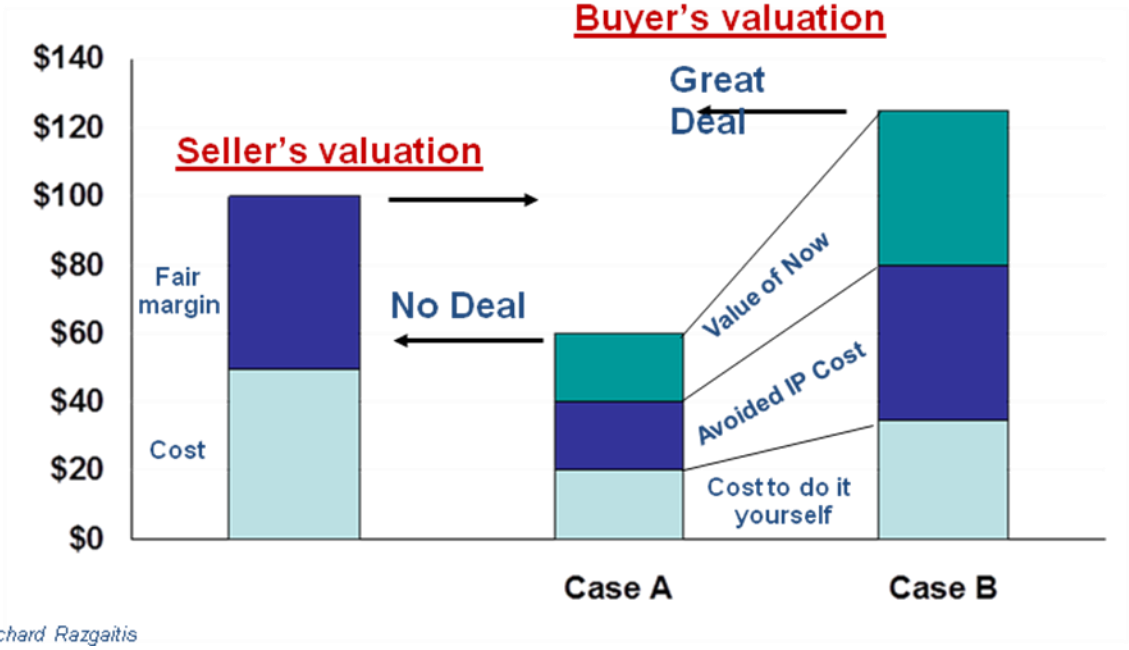
Consider the situation illustrated in Figure 4. The licensor has invested $50,000 to develop a technology and decides that a fair return on their investment is 100% or a further $50,000. They therefore offer the technology for license for $100,000.

Licensee A needs to use the technology and starts negotiating for rights to it. They base their negotiating position on their BATNA (Best Alternative To a Negotiated Agreement) which is to engineer round the licensor's IP. They estimate that the re-engineering will take a year and cost $20,000, that they'd need to license third party IP at a cost of a further $20,000 and that the year's delay in market entry will cost a further $20,000. Their valuation of the technology is therefore $60,000, so they will walk away from the negotiation.

Licensee B also needs to use the technology but their estimate of their costs to engineer round the licensor's IP themselves are very different. They estimate that the re-engineering will take two years and cost $40,000, that they'd need to license third party IP at a cost of a further $40,000 and that the two year delay in market entry will cost a further $40,000. Their valuation of the

technology is therefore $120,000. Since the asking price is only $100,000 they rapidly agree to the terms, and the Licensor has unknowingly left $20,000 on the table.

Figure 4: A Hypothetical Negotiation Using A Valuation Based On Cost



Source: Richard Razgaitis

However, despite its limitations, the cost method may be the only method available for a very early stage technology where no comparable transactions or any realistic market forecast can be made.

5.4.3. Benefits And Limitations Of A Cost Based Valuation

Benefits	Limitations
• Cost data is generally always available even at the earliest stages of a technology's development	• Fails to account for the value of the technology
• Simple to use	• Results in an economically inefficient negotiation

5.4.4. Example Of A Cost-Based Valuation

An excellent example of a cost-based valuation in actual practice is a venture philanthropy deal between the Cystic Fibrosis Foundation Therapeutics ("CFFT") and CombinatoRx, a Cambridge-based company with a proprietary screening technology to identify synergistic combinations of approved drugs to treat new diseases. CFFT agreed to pay CombinatoRx $13.8 million in research expenses and also to fund up to 75% of clinical development expenses through Phase 2a on the first potential product candidate. If the milestone was successfully reached, CFFT would make a payment to cover the remaining 25% of costs. CombinatoRx paid 100% of the costs from Phase 2b to NDA approval, but received milestone payments for success. On successful commercialization, CombinatoRx made royalty payments to CFFT which were capped at 2 times CFFT's payments to CombinatoRx. CFFT would therefore double their money.

5.5. Comparables/Industry Standard Valuation

5.5.1. Description

As we discussed in ¶5.2.1 above, comparing the price of something to another similar item is how most of us value things we encounter in the course of our daily lives. In everyday life, it is generally easy to obtain information on what the "market price" is for something we're interested in, particularly in the internet age.

But how does one go about finding out the "market price" for an intangible asset like IP, particularly for a patent, which, by definition, is unique.

It turns out there are a lot of ways to get such information:

Internal database
Published surveys
Public announcements
Word of mouth
Litigation
Required disclosure

5.5.2. Internal Database

The first place a licensing professional should look is within their own organization. Assuming that the person is not opening the first licensing office in that organization there will be a track record of past deals that can be mined for clues. If similar technologies have been licensed under similar terms for a number of years, that's probably an indication that those terms accurately reflect the "market price."

If on the other hand, transactions for similar IP over the years have resulted in terms that have trended steadily upwards, that's probably an indication that the organization's terms haven't yet reached the optimum "market price".

5.5.3. Published Surveys

Periodically individuals in the licensing profession carry out surveys and publish them, usually in the Journal of the Licensing Executive Society International, aka *les Nouvelles*. Such surveys are useful to establish the norms standards within an industry. How useful they are depends on how finely the survey slices and dices that industry into segments.

5.5.3.1. Degnan And Horton

One survey that has some useful information was published by Degnan and Horton in 19977. They looked at factors affecting valuation, relating them to the Georgia-Pacific factors8, and asked about the methodologies used, as shown in Table 2.

Table 2: Valuation Methodologies Used

Valuation Methodology	In-Licensing	Out-Licensing
Discounted Cash Flow	56%	49%
Profit Sharing Analysis	52%	54%
Return on Assets	38%	27%
25% Rule as a Starting Point	24%	30%
Capital Asset Pricing Model	11%	10%
Excess Return Analysis	8%	7%

They identified "industry standard" royalty rate ranges, relating them both to the magnitude of the technology's improvement over its predecessor and separating them into life sciences and other, which are relatively broad (and therefore imprecise) industry groupings.

Table 3: Relationship Of Royalty Rate To Magnitude Of Improvement

Median Royalty Rates	Pharma	Non-Pharma
Revolutionary	10-15%	5-10%
Major Improvement	5-10%	3-7%
Minor Improvement	2-5%	1-3%

7 "A Survey of Licensed Royalties" Stephen A. Degnan and Corwin Horton, les Nouvelles, June, 1997 Volume XXXII No. 2, 91-96

8 The Georgia-Pacific factors are 15 factors that Courts take into account in determining a reasonable royalty in patent infringement cases. They were enunciated in 1970 by Judge Tenney in an infringement suit over striated decorative plywood between Georgia-Pacific Corp. and U.S. Plywood Corp. (318 F.Supp. 1116 (S.D.N.Y. 1970)). The factors have been a mainstay of damages analyses in patent infringement suits to this day.

5.5.3.2. The Licensing Executives Society ("LES")

LES started conducting surveys of its members to determine deal terms in 2008. Their surveys divide industries into much more well defined segments than did Ge]]Degnan and Horton and are of great value to licensing professionals. The surveys are only accessible to members of LES, but membership in LES is extremely economical – $290 per year as of this writing – and an LES membership should be a high budget priority for any licensing professional. LES has carried out four surveys of three industries:

BioPharmaceuticals (2008, 2010)
Chemicals, Energy, Environmental and Materials (2010)
High Technology (2011)

The extracts of these surveys below are reproduced with LES's kind permission. It is important to note that the abstracts below are very much the "headline" results of the surveys. There is a wealth of additional information in all of the surveys, relating royalty rates to other characteristics of both the deal and the technology.

5.5.3.2.1. Biopharmaceuticals

LES's 2010 Global BioPharmaceutical Royalty Rates & Deal Terms Survey was published in September 2010. It was carried out by LES (USA & Canada) in conjunction with LESI (the global umbrella LES organization). 359 deals from 2008 and 2009 were submitted by LES members, of which 184 were deemed complete enough for inclusion. Two outliers were also excluded. 58% of the deals came from LES (USA & Canada), the rest from LESI members round the world. The deals reported included platform technologies and diagnostics. Deals were divided by stage of development.

Some of the overall conclusions from the survey were:

Deal Statistics

51% of the submitted deals were completed in 2008 and 49% were completed in 2009;

61% of reported deals were reported by the licensors;

Close to 40% of deals were related to small molecule drugs;

Anticancer (Oncology), CNS, and Infectious Disease deals were the most prevalent therapeutic area types submitted;

50% of all deals submitted were still in the Preclinical stage of development (Discovery & IND Track/ Pre-IND);

82% of deals were categorized as exclusive;

Over 80% of licenses included the U.S. and close to 63% of licenses were considered "Global" in scope;

62% of deals represented peak Annual Sales of greater than $US100 million.

Fixed and Tiered Royalties

Of the 184 deals, 105 deals were of the fixed royalty type, 48 were of the tiered royalty type, and 31 did not have any royalty components;

63% of fixed royalty deals were in the Preclinical stage while 33% of Tiered royalty deals were in the same stage.

Valuation

While "upfront payment" was the most frequently indicated financial component (87%), "sales milestones" displayed the greatest average ($65,200,000) and median ($10,000,000) amounts;

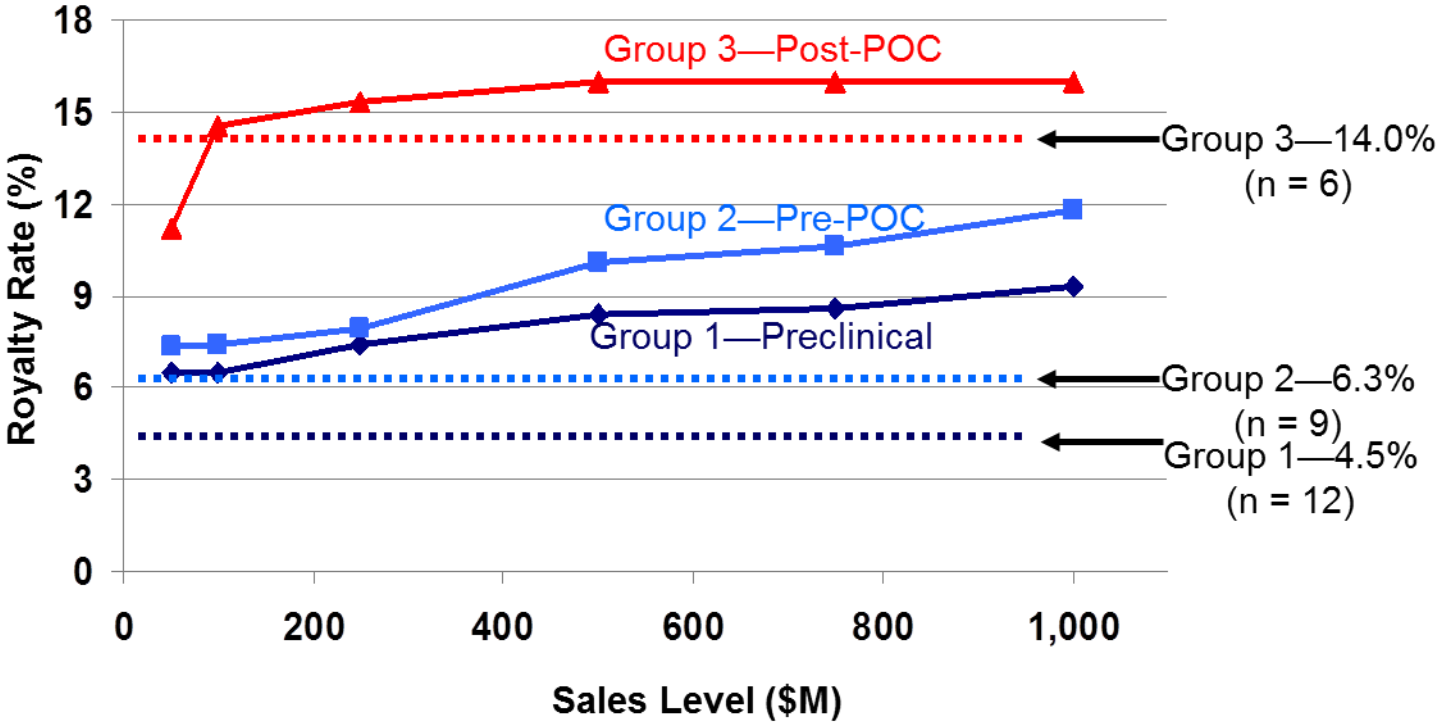
Significant differences in deal terms are noted in the Academic deals compared to Biotech and Pharma deals. This was especially evident through the differences in flat royalty rates and the amounts of payments upfront.

The 2010 BioPharmaceutical Survey went into considerably more detail than did its 2008 predecessor. Delivery methodology was covered in some detail, together with a considerably expanded list of therapeutic categories.

The vast majority of the deals reported were early stage, making then particularly helpful for academic institutions.

Figure 5 compares flat and tiered royalty rate structures by stage of development. With the exception of late stage (post-proof-of-concept) deals, where the lowest royalty tier was lower than the flat royalty rate, tiered royalty rates were uniformly higher than flat rates.

Figure 5: Comparison Of Flat And Tiered Royalty Rates By Stage Of Development



5.5.3.2.2. Chemical, Energy, Environmental And Materials

This survey was also published in 2010 and also was a collaboration of LES (USA & Canada) and LESI. 79 usable deals were received and analyzed, with 75% having been completed in 2008 and 2009.

Some of the key findings were:

The majority of deals collected (approx. 70%) contained flat running royalties;

Most deals were entered by the Licensor or Licensor's adviser;

Approximately 75% of the deals were executed during 2008 or 2009;

The Chemicals and Energy sectors represented approximately 80% of the deals;

Of those reported, approximately 40% of the deals estimated peak annual global sales of less than $50 million;

Most deals involved commercialized or soon to be commercialized products/technologies;

The majority of the deals were for exclusive licenses;

Most royalties were based on Net Sales;

Unit royalties appeared to be product or technology specific;

Most deals were world-wide and not limited to a geographic territory;

The typical license term was until the last to expire patent;

Over 50% of the deals contain other financial components, primarily Upfront and Milestone Payments;

Many licenses included audit (44%) or grant back provisions (32%);

Profit margins on licensed products/technologies varied;

Discounted Cash Flow, Market Comparables and a Rule of Thumb (e.g. 25% Rule) valuation analyses were considered.

Royalty rates by sector are shown in Table 4.

Table 4: Royalty Rates In Chemicals, Energy, Environmental And Materials Sectors

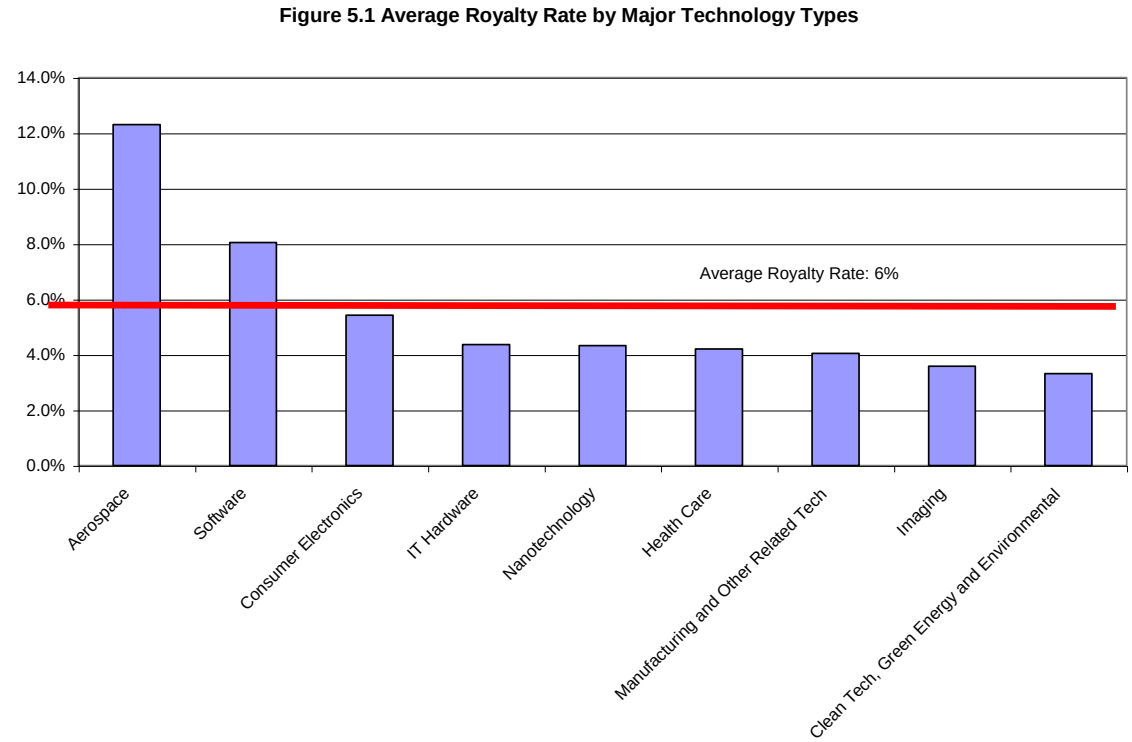
	Royalty Rate (%)		
Industry Segment	**Average**	**Min**	**Max**
Chemicals	5.73	0.13	25.00
Energy	4.93	0.50	15.00
Environmental/Materials*	3.67	0.50	7.50
Overall Segment	**5.25**	**0.13**	**25.00**

5.5.3.2.3. High Tech

The LES High Tech sector published its first deals survey in 2011. Fifty-two companies submitted information on 200 specific deals transacted from 2008 through 2011.

Average royalty rates by segment were as shown in Figure 6.

Figure 6 Average Royalty Rates Within High Tech Sector



5.5.4. Public Announcements

Public announcements of deals frequently contain some financial details. If either of the parties is publicly traded, they may be obliged to disclose some details (see Section 5.5.6 below).

Sometimes, the value of the deal is reduced to a single, very large number, the so-called "Bio Bucks" number. This is traditionally the sum of all the pre-commercialization payments lumped together and assumes a product successfully makes it all the way to market in every segment included in the license. The upfront payment, the only guaranteed figure, is generally revealed as well and is typically one tenth or less of the total potential payments.

Very early stage deals, such as those involving academic institutions rarely contain financial details.

5.5.5. Litigation

License terms are frequently made public in the course of litigation and can be helpful.

5.5.6. Required Disclosure

It is possible to obtain details on specific IP transactions from publicly available databases. It may be possible therefore to find deals that are comparable to the proposed transaction for which a valuation is being sought. This technique therefore has the potential to be much more precise than surveys, which generally generate only broad industry norms and standards.

The source of these comparable transactions is U.S. Securities and Exchange Commission ("SEC") regulations, which require publicly traded companies to publicly disclose details about material transactions to allow investors to assess the companies' financial status and prospects. Companies which are seeking to go public have to disclose and make public their material

transactions as part of the Initial Public Offering ("IPO") process, so that even if a company's investment bankers subsequently determine that they cannot sell the company's stock to the public, the material deals they have done up to the time of the abortive offering will have been deposited in the public domain and will remain there and accessible.

So, what is a "material transaction"? The safe harbor definition of a material transaction is a transaction that impacts 10% of a company's sales or 5% of its assets. The practical implications of this are that for multi-billion dollar revenue multinational corporations very few individual transactions meet this standard and need to be disclosed – settlements with generic drug Chapter IV challengers for blockbuster drugs such as Effexor XR® or Lipitor® are exceptions to this. Therefore, in general, small corporations are the primary source of useful comparable transaction data.

The useful information is found in one of five SEC required filings:

S-1 Registration statements for initial public offerings
S-3 Registration Statements for secondary public offerings
10K Annual Reports
10Q Quarterly Reports
8K Material Event Between Quarterly Filing Reports.

In all cases, the actual transaction documents are contained in Exhibits to these filings.

Companies can request Confidential Treatment for key financial information in these transaction documents, in which case the company files a complete version, which is kept confidential, and a redacted version, with the confidential material removed which is publicly accessible. However, the redaction is generally only good for five years, and it is possible to file a Freedom of Information Act ("FOIA") request with the SEC and obtain the unredacted version after 5 years. One of the database services listed below, Deloitte/ReCap, is particularly good at this and has the unredacted version for a large percentage of deals that are over five years old.

SEC corporate filings have always been publicly available. Formerly, there were four regional libraries which had paper/microfiche copies of all filings. Then in 1968, a company called Disclosure Information was established, based on the development of the first OCR scanning technology, to make copies available to the public.

In 1984, the SEC established a database, the Electronic Data Gathering, Analysis and Retrieval system, or EDGAR. The SEC opposed providing public access to EDGAR and signed a contract with Mead Data Central, which sold access at high prices through their Lexis/Nexis system. Librarians clamored for access to EDGAR and in 1993 the NSF funded a pilot project at NYU's Stern School of Business to make EDGAR available over the internet. The project was a great success and the SEC announced a program to transition all companies to electronic filing, starting with the largest companies on January 1, 1994 and culminating with all companies being required to file electronically on May 1, 1996.

The EDGAR system can be accessed directly at: www.sec.gov/edgar.shtml. Access is free.

A number of companies provide EDGAR access with enhanced services for a fee. A service that the author particularly likes and uses is 10-K Wizard9 (www.10kwizard.com). As of this writing, the service costs $380 per year. It has a particularly user friendly EDGAR interface, allowing selection of filing types in convenient groups, but its particular strength is that it makes finding and looking at Exhibits extremely easy, and, as noted above, license agreements are filed as Exhibits.

The challenge in using SEC filings as sources of comparables is finding the deals that might be useful and that have been filed with the SEC. The EDGAR system won't allow you to do this, nor will 10-K Wizard. For that you need a deals database.

There are a number of deals databases. Many just download SEC filings and make them accessible and so have the same basic cohort of agreements available. All charge for their

services, either on a subscription basis or per agreement accessed. A number of the databases that the author is familiar with are summarized in Table 5.

Table 5: Deal Databases

Name	URL	Cost	Comments
RoyaltySource	royaltysource.com/	• Agreements without terms, user searchable, $500 per year subscription • Agreements with terms, they do the search. $100 minimum charge, $250 to download 10 agreements	Good for physical sciences
TechAgreements	www.techagreements.com	$35/agreement	Can search and see one page agreement preview for free
RoyaltyStat	www.royaltystat.com/	License agreement subscription costs $4,500, limit of 100 agreement downloads	Can only search by SIC and NAISC code
Business Valuation Resources	www.bvresources.com/	One day pass to ktMine is $495	
Recap by Deloitte	www.recap.com	Two levels: IQ $15,000 - $26,000 per year depending on number of users Explorer $1,000 per year + $100 per extra seat; $500 set up fee; Both levels offer 50% discount for non-profits	See discussion below

9 The investment research and data company Morningstar bought 10K Wizard in December 2008

PharmaDeals	www.pharmadeals.net/		Life science focused ~47,000 deals in database
Windhover	www.elsevierbi.com/deals	Can search for free	Windhover was acquired by Elsevier in 2008

5.5.6.1. Recombinant Capital/Deloitte ("Recap")

Recap is, in the author's opinion, the state of the art for finding life sciences deals and is the service that he has used for a number of years. The database was started by Mark Edwards as Recombinant Capital and was acquired by Deloitte in 2008. In June 2013, Thomson-Reuters acquired the database from Deloitte.

As of this writing, there are 36,000 entries in its database. As noted in Table 5, there are two levels of subscription available:

IQ Series: $15,000 - $26,000 per year depending on number of users, 50% discount for non-profits (and somewhat negotiable)

IQ Series is Recap's premier service. It offers:

- Unlimited access to the full text of all deals
- A number of deals have had their key terms abstracted into a standard format
- The ability to download search results into an Excel spreadsheet for further analysis

Explorer: $1,000 per year + $100 per extra seat; $500 set up fee; The fee can be applied to individual transaction documents: $200 per transaction ($300 if first to request). There is a 50% discount for non-profits on all charges.

Explorer is a lower cost option. It provides a summary of deals and a summary of the financial terms.

Particular strengths of Recap are:

Going back to the SEC and obtaining unredacted copies of agreements after 5 years;
Including details of announced deals that aren't filed with the SEC.

5.5.6.2. Search Strategies

Three search strategies emerge from this analysis:

No Cost Search Strategy:

- Identify relevant agreements using TechAgreements or Windhover;
- Obtain the agreements from EDGAR.

Low Cost Life Sciences Search Strategy:

- Use recap.com, cost $500 per year for an academic institution;
- Get first 5 agreements from Recap.

- Obtain subsequent agreements from EDGAR

High Cost Life Sciences Search Strategy

- Use rDNA, cost ~$7,500 for an academic institution;

- Get all agreements from rDNA.

5.5.7. Benefits And Limitations Of A Comparable-Based Valuation

Benefits	Limitations
• A lot of data on comparable transactions is available from published surveys and databases	• Can be expensive to access
	• Results of recent transactions may not be available
	• Decline in IPO's has reduced the number of new deals being filed with the SEC

5.6. Ranking/Rating

5.6.1. Description

Ranking and Rating refers to a systematic process of assessing technologies by a number of criteria.

All technology transfer offices must assess the technologies their faculty submit to them, a process also known as "triaging" inventions. If this methodology is applied in a systematic, quantitative method, the numerical ratings that are determined for each technology can provide a

useful guide to their likely value by reference to prior technologies that were successfully licensed.

The author teaches and uses a First Look Technology Assessment methodology which generates a Commercial Potential Rating.

Suppose a technology addressed a market that could potentially be large but is currently relatively undeveloped, the technology had been shown to work in the anticipated commercial setting, and was vastly superior to competitive technologies and had received an excellent patentability opinion, then the Commercial Potential rating would be as shown in Table 6.

Table 6: Example Of A First Look Technology Assessment Commercial Rating Potential

Factor	**Weight**	**Score (1-5)**
Market Potential	25%	4
Market Maturity	15%	1
Technology Development	30%	4
Competition	15%	4
Patentability	15%	4
Commercial Potential Rating		3.55

Technologies which receive ratings below 3 are unlikely to be commercializable.

5.6.2. Benefits And Limitations Of A Ranking-Based Valuation

Benefits	**Limitations**
• Builds on an organizations' experience base	• Not applicable in new organizations
	• Yields a relative valuation basis, not an absolute valuation

5.7. Auction

5.7.1. Description

In an auction, a seller advertises that an item is for sale and sets rules under which interested parties may bid on the property.

The approach has been applied to IP. When a company enters bankruptcy protection, if the Court and the creditors decide that the company cannot be shrunk down to a viable core business, its assets will be auctioned off, including its IP. These auctions are normally conducted through successive rounds of sealed bids.

More recently, in 2006 the company Ocean Tomo started six monthly auctions of patents using the traditional "open outcry" method of bidding. Sales volume slowly decreased and the brokerage firm ICAP took over the business in 2009.

Auctions are better suited to physical sciences inventions, where there isn't a lot of data that needs to be reviewed – it's difficult to get multiple bidders to do due diligence on an asset to allow them to bid enthusiastically.

5.7.2. Benefits And Limitations Of An Auction-Based Valuation

Benefits	Limitations
• Achieves the full market value	• Better suited to physical sciences inventions
	• If a technology doesn't attract bidders , it will be perceived as "damaged" and may be more difficult to market.
	• Results in an upfront payment only, no running royalties.

5.7.3. Example Of An Auction-Based Valuation

The best known example of a biotechnology patent auction was the auction of the leptin gene by Rockefeller University in 1995. One of the gene's discoverers, Jeffrey Friedman, was a co-founder of Millenium and wanted them to get the license to the gene. However, Friedman was a Howard Hughes investigator and the Howard Hughes Medical Institute, insisted on an auction. Amgen won with a bid of $80 million, of which $20 million was upfront. This is still the largest amount ever paid for a single gene.

5.8. Rules Of Thumb

5.8.1. Description

The most venerable rule of thumb in licensing is the 25% rule, which states that:

"The Licensor should receive 25% and the Licensee should receive 75% of the pre-tax profits from a licensed product"

5.8.2. History of the 25% Rule

The realization that the royalty rate that could be charged for a technology must be related to the profitability of products that resulted from the license dates back to a patent infringement case in 193810, in which the plaintiff's expert stated:

… ordinarily royalty rights to the inventor should bear a certain proportion to the profits made by the manufacturer and that the inventor was entitled to a 'proportion ranging from probably ten per cent of the net profits to as high as thirty per cent,' which should be graduated by the competitive situation.

---

10 Horvarth v. McCord Radiator and Mfg. Co. et al., 100 F.2d 326, 335 (6th Cir. 1938)

Not surprisingly, the rule was first formally enunciated by the U.S.'s first major patent licensing organization, Research Corporation11, by its General Counsel, Albert S. Davis12, who wrote:

If the patents protect the Licensee from competition and appear to be valid the royalty should represent about 25% of the anticipated profit for the use of the patents.

However, the rule is most commonly associated with Robert Goldscheider – indeed it is sometimes referred to as the Goldscheider Principle13.

In the late 1950's, Goldscheider was an advisor to the American consumer products company Philco, which manufactured radios, phonographs, TV's, washers and dryers. It manufactured and sold its products in the U.S. and Canada and operated internationally through 18 exclusive licensees, two of whom Philco subsequently acquired, which for tax reasons were managed through its Swiss subsidiary14.

Philco supported their licensees very well, providing them with:

A series of patent-protected product innovations;
Well documented and regularly updated binders of trade secrets, maintained strictly confidentially;
Annual meetings of licensees for exchange of ideas and know-how;

---

11 Research Corporation ("RC") was established in 1912 by Edward Cottrell11, a professor of chemistry at the University of California, who had invented the electrostatic precipitator to remove the pollution emitted by the zinc smelters that ringed San Francisco Bay. Cottrell decided that the commercialization should be carried out outside academia and set up RC, at the time only the second foundation to be set up in the US, with the assistance of the Smithsonian Institution. The proceeds from Cottrell's precipitator provided the operating funds for RC, which would accept inventions from academic inventors, pay all the costs of patenting and commercializing their inventions and return a large part of the income to the academic institution. RC was the primary vehicle for academic technology commercialization in the US prior to the passage of the Bayh-Dole Act, after which the majority of academic institutions established their own TTO's.

12 "Basic Factors to be Considered in Fixing Royalties" in "Patent Licensing", Patent Law Institute, 1958

13 Robert Goldscheider and James T. Marshall "The Art of Licensing -- From a Consultant's Point of View", 2, The Law and Business of Licensing 645 (1980)

14 "The Classic 25% Rule And The Art Of Intellectual Property Licensing", Robert Goldscheider, les Nouvelles, XLVI No. 3, 148-159 (September 2011)

A SWAT team of engineers ready to fly out on 24 hours' notice and solve any problems;
A set of brandnames.

Although they faced competition both from bigger companies, such as General Electric, RCA and Koninklijke Philips Electronics N.V., and smaller ones, Philco's licensees were all first or second in their markets. The licenses were for three years and all of the licensees willingly renewed the licenses at the end of the term without seeking to renegotiate the terms.

As Goldscheider studied the relationships between the licensees and Philco, he observed that the licensees were paying a relatively high royalty rate – 5% – and were making a pre-tax profit of around 20%. The licensees' ready willingness to renew the licenses under the same terms led him to conclude that the license terms resulted in a sustainable win-win relationship. He went on to make similar observations in other quite different areas of technology.

The 25% Rule is therefore probably the oldest valuation methodology in licensing.

When Judge Tenney enunciated the 15 Georgia-Pacific factors in 1970 in the patent infringement suit between Georgia-Pacific Corporation and U.S. Plywood Corporation15, the 25% Rule started a whole new career in litigation, in Georgia-Pacific Factor 13:

The portion of the realizable profit that should be credited to the invention as distinguished from non-patentable elements, the manufacturing process, business risks, or significant features or improvements added by the infringer.

5.8.3. Recent Developments With The 25% Rule

However the 25% Rule's role in litigation recently came under attack in the case of Uniloc USA, Inc. and Uniloc Singapore Pvt, Ltd, vs Microsoft Corporation16, a patent infringement case

15 Georgia-Pacific Corp. vs. U.S. Plywood Corp. 318 F.Supp. 1116 (S.D.N.Y. 1970)

involving U.S. Patent 5,490,216 "System for software registration", a method of preventing multiple installations of the same software on different computers. The District Court in Rhode Island said:

the concept of a 'rule of thumb' is perplexing in an area of the law where reliability and precision are deemed paramount

but allowed use of the rule. The case was appealed to the CAFC which issued its opinion on January 11, 2011. The Court said the rule:

Fails to take into account the unique relationship between the patent and the accused product
Fails to take into account the unique relationship between the parties
Is essentially arbitrary and does not fit within the model of the hypothetical negotiation within which it is based

The Court went on to say:

"The Court has passively tolerated its use where its acceptability has not been the focus of the case".

and concluded:

"This court now holds as a matter of Federal Circuit law that the 25 percent rule of thumb is a fundamentally flawed tool for determining a baseline royalty rate in a hypothetical negotiation. Evidence relying on the 25 percent rule of thumb is thus inadmissible under Daubert and the Federal Rules of Evidence, because it fails to tie a reasonable royalty base to the facts of the case at issue."

16 Uniloc USA, Inc. v. Microsoft Corp., 632 F. 3d 1292

Goldscheider has argued[17] that the Court failed to understand the Rule, and that the Rule was only intended to supply a baseline royalty rate which would then be adjusted for other case-specific facts to address the Court's concerns. However, it will be a brave Expert who uses the term "25% Rule" in any future Expert Report.

That said, there seems to be consensus that the 25% Rule will retain an important role in the context of licensing even though it is dead in litigation.

5.8.4. Applying The 25% Rule

As a general proposition, as discussed in ¶2.2.7.2 above, it is wise to express royalty rates in terms of Net Sales, not Net Profits. So the next question that arises is: "What profit margin do I use?"

One option is to ask the licensee for the profit margin they are using in their internal business plan for the product. After all, it is generally prudent to ask any prospective licensee(s) for their business plan for the products resulting from a technology they want to license.

In the spirit of Ronald Regan's famous quotation "Trust but Verify", how can the licensor double check the figures the licensee provides? There are a number of options they could look at:

17 "The Classic 25% Rule And The Art Of Intellectual Property Licensing", Robert Goldscheider, les Nouvelles, XLVI No. 3, 148-159 (September 2011)

The licensee's overall profit margin

This only works for established companies with revenues, not for development stage companies

A benchmark group. There are a number of sources of profitability analyses:

- Business Week surveys
- Almanac of Business and Industrial Financial Ratios
- Mergent Industry Review
- Robert Morris Associates Annual Statement Studies

A "pure play" in that industry

- An established company that just sells that particular product.

5.8.5. The 25% Rule And Tiered Royalty Rates

In the discussion of royalty rate structures in Section 2.2.7.2 above, the comment was made that if the parties agree that the royalty rate the licensee will pay will be different at different sales levels, then the rate should be higher at higher sales levels. The data from the LES Biopharmaceutical Survey in Section 5.5.3.2.1 above showed that this is the case with pharmaceuticals.

The 25% Rule provides a theoretical foundation for this. All other things being equal, a product with high sales has a higher profit margin than a similar product that has lower sales – the high

selling product benefits from economies of scale in every aspect of its manufacture, marketing, sales, distribution and support. Therefore it can afford to pay a higher royalty rate to the licensor of the technology.

5.8.6. Benefits And Limitations Of A Rule of Thumb-Based Valuation

Benefits	Limitations
• Broadly applicable – if a company is seeking a license to a technology it must be because they believe they will derive some business benefit, either increased sales or decreased costs	• The 25% must be apportioned over all the technologies the licensee will need to develop e finished product
	• The licensee may resist giving 25% of their net profits if they have to make a massive investment to develop and market a product

5.9. Discounted Cash Flow/Net Present Value

5.9.1. Description

Valuing a technology using the discounted cash flow or net present value methodology involves trying to work out what the true value of the technology is – in other words, estimating the financial flows that will result from successfully developing the technology and making and selling products based on it. These financial flows will generally be:

First a negative cash flow phase consisting of the costs to develop and launch the technology (i.e. an investment phase); followed by

A positive cash flow consisting of the profits earned from selling the resultant products (i.e. a return on investment).

Superficially, this may look to be a relatively straightforward analysis, albeit one that involves forecasting the unknown. However, in practice, in addition to the difficulty of forecasting the unknown, the analysis needs to take into account several additional factors:

The time value of money
The risk inherent in the development process

- If the licensee commits to developing the technology, they will certainly incur the development costs of the technology;

- However, they may not succeed in successfully developing a product, and

- The market success or failure of the resultant products will not be known until after all the costs have been incurred.

5.9.2. The Time Value Of Money

Money in our hands today is inherently worth more than the promise of receiving money tomorrow. So let's try and answer the question: "What's a promise to receive $1,000 in a year's time worth today?"

So first let's ask what would it take to make us invest $1,000 for a year today? Say we'd be happy with a 7% return:

3% to account for inflation; and
4% as a real return.

This assumes that the investment is absolutely guaranteed – say U.S. Treasury Bills ("T-Bills"). If there is a risk that the investment won't be repaid, then we'd expect a higher return in order to take that risk into account.

However, if the investment was absolutely secure, then we'd expect to get back $1,070 in a year's time if we invest $1,000 today. That means we'd be prepared to invest $934.58 ($1,000/1,070) today to receive $1,000 in a year's time:

7% of $934.58 is $65.42;
$934.58 + $65.42 = $1,000.

Therefore, $934.58 is the Net Present Value of $1,000 **one year** in the future with a discount rate of 7%.

7% is the interest rate going forwards, and the discount rate going backwards.

What about if we left our money invested for a second year – would we expect a further $70 interest? No – we'd expect more because we'll have $1,070 invested for the second year – the original $1,000 investment plus the $70 interest we've earned in the first year.

7% of $1,070 is $74.90,
We'd expect to receive $1,144.90 at the end of year 2.

That means we'd be prepared to invest $873.44 today ($1,000/$1,144.90) to receive $1,000 in two years' time:

7% of $873.44 is $ $61.14;

$873.44 + $ $61.14 = $934.58 at the end of year 1, and

The same calculation as above gets us back to $1,000 at the end of year 2.

Therefore, $873.44 is the Net Present Value of $1,000 **two years** in the future with a discount rate of 7%.

What about if we wanted to receive $1,000 in each of the next two years? Then we'd be prepared to pay $934.58 to receive $1,000 at the end of year 1 and $873.44 to receive $1,000 at the end of year 2, for a total of $1,808.02. Therefore $1,808.02 is the Net Present Value of two payments of $1,000 **one and two years** in the future with a discount rate of 7%.

We can convert these calculations to a mathematical formula. Let's look at the two year calculation. Let's call the money we expect to receive the Final Value ("FV") and the money we are prepared to pay the Present Value ("PV"). Let's call the Interest Rate/Discount Rate "k".

In the case of our $1,000 investment, the value after one year is:

Value = $1,000 + ($1,000 * 0.07); or

$FV = PV + PV * k$; or

$FV = PV * (1 + k)$

and the value after two years is

Value = $1,000 + ($1,000 * 0.07) + ($1,000 + ($1,000 * 0.07) * 0.07); or

$FV = PV + PV * k + PV * k + PV * k^2$; or

$FV = PV + 2 * PV * k + PV * k^{2;}$ or

$FV = PV * (1 + k)^2$

If we were to create a formula for the value of our $1,000 after three years, we'd find that it would simplify down to:

$$FV = PV + (1 + k)^3$$

and it turns out that the general formula is:

$$FV = PV + (1 + k)^n$$

where "n" is the number of years in the future that the payment will be made.

Correspondingly, to determine PV, the Present Value, of some FV, or Future Value, a given number of years in the future, the formula is simply

$$PV = FV / (1 + k)^n$$

5.9.2.1. The Discount Rate

Because the 1 + k term is raised to the power "n", the value of k has an enormous impact on Future Values a long way in the future. The choice of an appropriate discount rate is therefore critical to successful NPV calculations.

Interest rates (and hence discount rates) are tightly tied to risk that the borrower will default. The higher the possibility that the borrower will default, the higher the interest rate that the lender will demand in order to compensate them for this risk. In our personal lives, the mortgage on our home will generally carry the lowest interest rate that we can obtain, and the interest rate on the unpaid balance of our credit card bill will generally be one of the highest. This is because if we default on the mortgage, the lender can foreclose on the loan and sell the house to get their money back, while the credit card company will have to pursue us through the courts and run the risk of driving us into bankruptcy.

5.9.2.2.

5.9.2.3. Some Discount Rates

Inflation

a) Inflation rates vary. In the mid-1970's and again in the early 1980's, inflation rates spiked at 10-12%. By contrast, in 2009, the U.S. actually experienced price deflation, with prices dropping compared with the previous year. However, over the long haul, inflation has averaged around 3%.

U.S. Treasury Bonds

b) U.S. Treasury securities are generally regarded as risk free, despite the downgrading of the U.S. credit rating in August 2011. The yield on the 10 year U.S. Treasury Note18 has therefore been regarded as a bellwether indicator of the long term, risk-free return that capital markets expect. This rate varies with long term capital markets, and in the current, post 2008 environment has been down below 2%. However over the long term, the rate has been closer to 6%. The US Treasury has also issued 20 and 30 year bonds. While these have not always been available, their interest rates have typically been 0.5% - 1% higher.

Corporate Bonds

c) Corporations don't have the taxing authority of the U.S. Government behind them, so their bonds are perceived to be inherently higher risk than U.S. Treasury Notes and Bonds. A company could go bankrupt, or even be expected to go bankrupt, which would lower the price someone would pay for the company's bonds, so companies must pay higher interest rates than the U.S. Government. While corporate bond rates, like Treasury Bond rates, are currently considerably below long term rates, interest rates for blue chip companies averaged 12% in the period 1980-2000, while junk bonds averaged 18%.

Weighted Average Cost of Capital ("WACC")

d) Companies raise capital through a variety of means, each of which has a different cost:

- Long term borrowing

18 The US Treasury issues many types of debt instrument, which have different names, depending on their duration. Treasury Bills have a maturity of a year or less. Treasury Notes mature in two to ten years. Treasury Bonds have maturities of twenty or thirty years.

- Short term borrowing

- Equity

e) The Weighted Average Cost of Capital for a company is the cost of each of these sources of capital, weighted by the extent they make up the company's capital structure. Because both long and short term interest rates are currently below historical norms, so is the weighted average cost of capital for most corporations Historically, most blue chip companies have had WACC's of from 11-15%, but current rates are significantly lower. There are two services that will provide the WACC for specific companies -- Morningstar's (formerly Ibbotson & Associates') Stocks, Bonds, Bills & Inflation and Duff & Phelps' Risk Premium Report.

f) Corporate Investment Hurdle Rate

g) Companies have an internal hurdle rate for investment proposals that is typically double their WACC, or 30%.

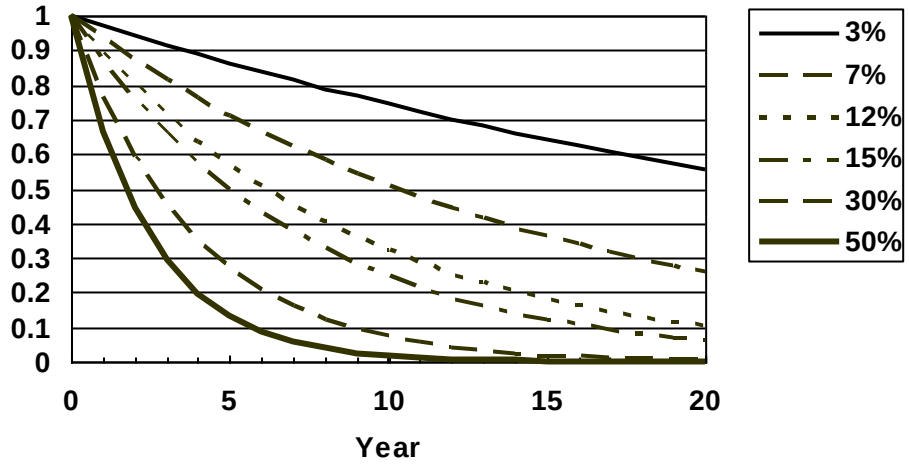
h) Venture Capital Hurdle Rate

i) Venture capital investments are so high risk that VC's demand a 50% annual return on their investments.

5.9.3. Impact Of Discounting Over Long Time Periods

Figure 7 shows the Final Value by year over 20 years as a function of the discount rates discussed above.

Figure 7: Impact of Discount Rate on Value Over Long Periods



Several conclusions emerge from these graphs. First, even at a 3% discount rate, which we said was the long term inflation rate, the final value has decreased to just over 50% of the initial value after 20 years. Second, the magnitude of the discount rate has an enormous impact on the future value. At a 7% discount rate, the value is down to 25% of the initial value after 20 years, while at 12%, the value is down to 10% of the initial value after 20 years. At a 30% discount rate, the value is down to less than 10% of its initial value after just 10 years, while at a 50% discount rate, the value is down to 10% of its initial value after only 5 years.

Another way of looking at discount rates is in terms of the pay-back – the multiple of the initial investment that we get back at the end of the investment period.

Table 7 shows the pay-back after 5 years for various discount rates. The formula is:

$$PV = \$1{,}000/(1+k)^5$$

Table 7: Net Present Value of $1,000 in Five Years

k	Present Value	Payback
3%	$862.61	1.15x
7%	$712.99	1.40x
12%	$567.43	1.76x
15%	$497.18	2.01x
30%	$269.33	3.71x
50%	$131.69	7.59x

At a 3% discount rate, we get back 15% more than we've invested. This is close to intuitive – at a 3% growth rate, compounding doesn't have much effect, so the payback is close to 5 * 3% or 15%. At higher discount rates, compounding starts to come into play. So at 7%, the payback is

40%, which is somewhat higher than 5 * 7% or 35%. At 15%, the payback is over 2, i.e., we get back more than double our investment, while at 30% the payback is close to 4 and at 50% it's close to 8.

5.9.4. NPV And A Typical R&D Project

So, let's apply these concepts to a hypothetical drug development R&D project, the same one that we looked at the license terms for in ¶3 above.

Table 8 Cash Flow Of A Hypothetical Drug Development Project

		Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Cash Flow Analysis									
1. Income Statement									
Net Sales			$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$100.0
Costs									
R&D	13.0%		($5.0)	($10.0)	($30.0)	($50.0)	($50.0)	($30.0)	($13.0)
COGS	19.0%								($19.0)
Marketing, Sales G&A	28.0%								($28.0)
Total Costs	60.0%		($5.0)	($10.0)	($30.0)	($50.0)	($50.0)	($30.0)	($60.0)
Pre Tax P/(L)	40.0%		($5.0)	($10.0)	($30.0)	($50.0)	($50.0)	($30.0)	$40.0
Tax	35.0%		$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	($14.0)
After Tax P/(L)			($5.0)	($10.0)	($30.0)	($50.0)	($50.0)	($30.0)	$26.0
2. Adjustments to P/(L) to Generate Cash Flow									
Capital Investment				($5.0)				($20.0)	
Depreciation	5.0%								$1.0
Change in Working Capital	8.3%								($8.3)
Net Cash Flow			($5.0)	($15.0)	($30.0)	($50.0)	($50.0)	($50.0)	$18.8

	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14
Cash Flow Analysis							
1. Income Statement							
Net Sales	$200.0	$400.0	$600.0	$800.0	$1'000.0	$1'050.0	$1'100.0

Costs								
R&D	13.0%	($26.0)	($52.0)	($78.0)	($104.0)	($130.0)	($136.5)	($143.0)
COGS	19.0%	($38.0)	($76.0)	($114.0)	($152.0)	($190.0)	($199.5)	($209.0)
Marketing, Sales G&A	28.0%	($56.0)	($112.0)	($168.0)	($224.0)	($280.0)	($294.0)	($308.0)
Total Costs	60.0%	($120.0)	($240.0)	($360.0)	($480.0)	($600.0)	($630.0)	($660.0)
Pre Tax P/(L)	40.0%	$80.0	$160.0	$240.0	$320.0	$400.0	$420.0	$440.0
Tax	35.0%	($28.0)	($56.0)	($84.0)	($112.0)	($140.0)	($147.0)	($154.0)
After Tax P/(L)		$52.0	$104.0	$156.0	$208.0	$260.0	$273.0	$286.0
2. Adjustments to P/(L) to Generate Cash Flow								
Capital Investment								
Depreciation	5.0%	$1.0	$1.0	$1.0	$1.0	$1.0	$1.0	$1.0
Change in Working Capital	8.3%	($8.3)	($16.5)	($16.5)	($16.5)	($16.5)	($4.1)	($4.1)
Net Cash Flow		$44.8	$88.5	$140.5	$192.5	$244.5	$269.9	$282.9

		Year 15	**Year 16**	**Year 17**	**Year 18**	**Year 19**	**Year 20**	**Total**
Cash Flow Analysis								
1. Income Statement								
Net Sales		$1'050.0	$1'000.0	$900.0	$800.0	$700.0	$600.0	$10'300.0
Costs								
R&D	13.0%	($136.5)	($130.0)	($117.0)	($104.0)	($91.0)	($78.0)	($1'514.0)
COGS	19.0%	($199.5)	($190.0)	($171.0)	($152.0)	($133.0)	($114.0)	($1'957.0)
Marketing, Sales G&A	28.0%	($294.0)	($280.0)	($252.0)	($224.0)	($196.0)	($168.0)	($2'884.0)
Total Costs	60.0%	($630.0)	($600.0)	($540.0)	($480.0)	($420.0)	($360.0)	($6'355.0)
Pre Tax P/(L)	40.0%	$420.0	$400.0	$360.0	$320.0	$280.0	$240.0	$3'945.0
Tax	35.0%	($147.0)	($140.0)	($126.0)	($112.0)	($98.0)	($84.0)	($1'442.0)
After Tax P/(L)		$273.0	$260.0	$234.0	$208.0	$182.0	$156.0	$2'503.0
2. Adjustments to P/(L) to Generate Cash Flow								
Capital Investment								($25.0)
Depreciation	5.0%	$1.0	$1.0	$1.0	$1.0	$1.0	$1.0	
Change in Working Capital	8.3%	$4.1	$4.1	$8.3	$8.3	$8.3	$8.3	($49.5)
Net Cash Flow		$278.1	$265.1	$243.3	$217.3	$191.3	$165.3	$2'442.5

First, let's assume that the company discovered the drug itself in-house and that the drug is ready to enter pre-clinical development. We are interested in valuing the technology at this stage, say to determine whether the investment to complete clinical development is justified.

Table 8 shows the financial flows of the project. The drug company has to invest $175 million over 6 years to receive FDA approval, sales start in year 7, increase and hit a peak in year 14 and then start to slowly decline down to 50% of their peak in year 20 when the patents expire and there are no sales in year 2119.

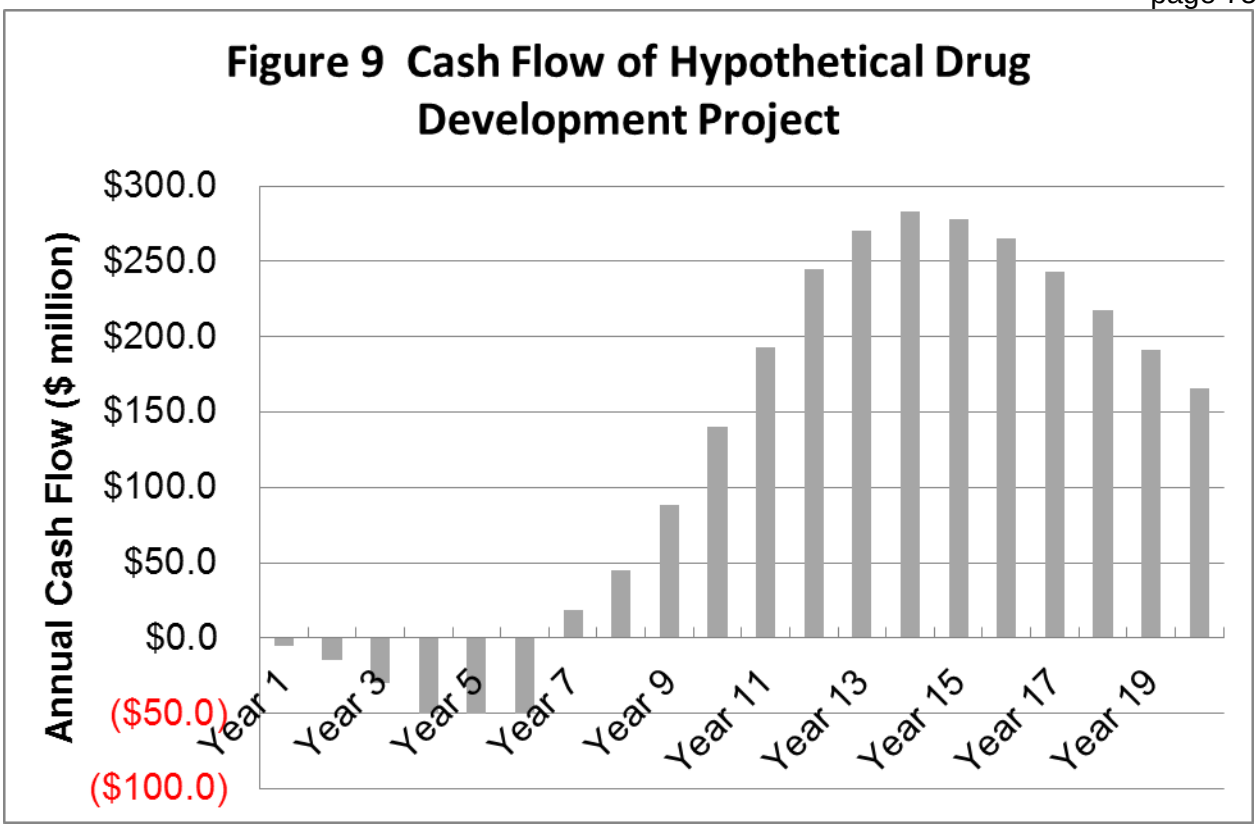
First, we develop the P/(L) statement. The various operating costs – cost of goods, R&D, marketing, sales and G&A – in Table 8 are based on Glaxo's cost structure in their 2012 annual report, which shows a 40% pre-tax margin. The analysis assumes the company pays corporate taxes of 35% of profits.

Next, we adjust the after tax P/(L) to get to cash flow. First, we allow for capital expenditures, which are a negative cash flow. Next we allow for the changes in working capital. As sales ramp up, more working capital is needed, which results in another negative cash flow, while when sales start to decline, working capital is released, resulting in a positive cash flow. Finally, we allow for depreciation. Depreciation is a non-cash component of operating costs, so we add it back, resulting in a positive cash flow.

The resulting after-tax cash flow of our hypothetical drug development project is shown in Figure 8. Total after tax cash flow is $2,442.5 million which exceeds total expenses by $2,265.5 million, so the investment looks like a pretty good deal, right?

Figure 8: Cash Flow Of A Drug Development Project

19 In the real world, patent life would be longer than 20 years because (a) the initial filing would be as a provisional patent application, the year of pendency of which does not count towards the 20 year term of the patent (b) there would be additional, later filings such as one or more method of treating patents, (c) there would be patent term extension for time lost in the regulatory process and (d) the product would retain 10-15% of its sales in the first year of generic entry and probably 5% of its sales thereafter.



Now let's start discounting the cash flows at various discount rates.

To calculate the discount factors, we pick a cell to hold the discount rate, k. Then we calculate a discount factor for each year.

For year 0, the discount factor is 1.

For the subsequent years, the revenues and expenses will be recognized roughly equally throughout the year, so to calculate the NPV, we assume as an approximation that the sales and expenses occur at midyear. Therefore, for the first year, the discount factor formula is $1/(1+k)^{0.5}$ or, in MS Excel formulation, 1/(1+k)^0.5.

For year 2 the discount factor formula is $1/(1+k)^{1.5}$ which is year 1's discount factor divided by (1+k). Similarly, for year 3, the discount factor is $1/(1+k)^{2.5}$, which is the year 2 discount factor

divided by a further (1+k), for year 4, the discount factor is the discount factor is $1/(1+k)^{3.5}$, which is the year the year 3 discount factor divided by a further (1+k), and so on.

We then multiply each year's cash flow by that year's discount factor to generate the discounted cash flow or NPV for that year.

Finally, we add up all the discounted cash flows and we have the NPV of the entire project. Table 9 shows that the NPV of our hypothetical drug development project at a 30% discount rate is $14.8 million.

Table 9: NPV Of Hypothetical Drug Development Project With A 30% Discount Rate

		Year 0	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**
Stage			Preclinical	Phase 1	Phase 2	Phase 3	Phase 3	NDA	Marketed
Cash Flow Analysis									
1. Income Statement									
Net Sales			$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$100.0
Costs									
R&D	13.0%		($5.0)	($10.0)	($30.0)	($50.0)	($50.0)	($30.0)	($13.0)
COGS	19.0%								($19.0)
Marketing, Sales G&A	28.0%								($28.0)
Total Costs	60.0%		($5.0)	($10.0)	($30.0)	($50.0)	($50.0)	($30.0)	($60.0)
Pre Tax P/(L)	40.0%		($5.0)	($10.0)	($30.0)	($50.0)	($50.0)	($30.0)	$40.0
Tax	35.0%		$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	($14.0)
After Tax P/(L)			($5.0)	($10.0)	($30.0)	($50.0)	($50.0)	($30.0)	$26.0
2. Adjustments to P/(L) to Generate Cash Flow									
Capital Investment				($5.0)				($20.0)	
Depreciation	5.0%								$1.0
Change in Working Capital	8.3%								($8.3)
Net Cash Flow			($5.0)	($15.0)	($30.0)	($50.0)	($50.0)	($50.0)	$18.8
Discount Factor	30.0%	1.000	0.8771	0.6747	0.5190	0.3992	0.3071	0.2362	0.1817

NPV		($4.4)	($10.1)	($15.6)	($20.0)	($15.4)	($11.8)	$3.4

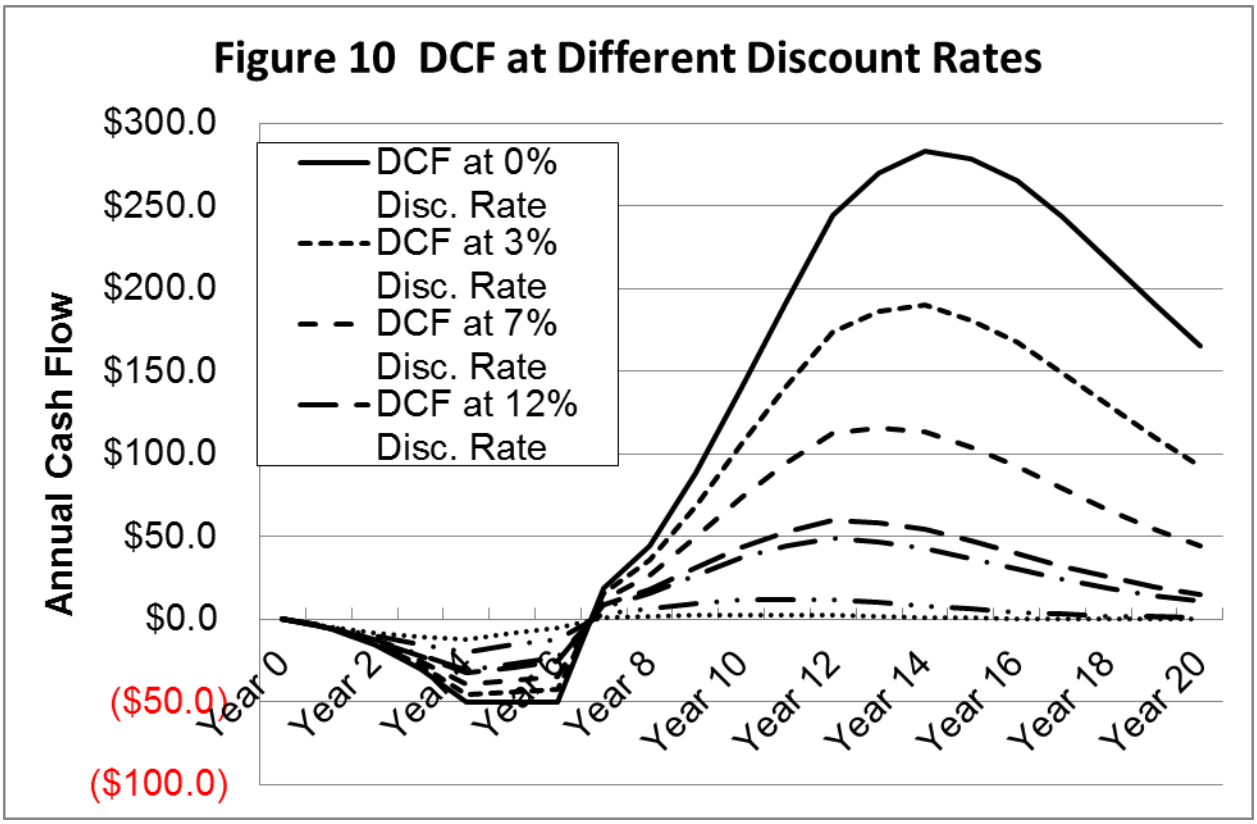
		Year 8	**Year 9**	**Year 10**	**Year 11**	**Year 12**	**Year 13**	**Year 14**
Stage		Marketed	Marketed	Marketed	Marketed	Marketed	Marketed	Marketed
Cash Flow Analysis								
1. Income Statement								
Net Sales		$200.0	$400.0	$600.0	$800.0	$1'000.0	$1'050.0	$1'100.0
Costs								
R&D	13.0%	($26.0)	($52.0)	($78.0)	($104.0)	($130.0)	($136.5)	($143.0)
COGS	19.0%	($38.0)	($76.0)	($114.0)	($152.0)	($190.0)	($199.5)	($209.0)
Marketing, Sales G&A	28.0%	($56.0)	($112.0)	($168.0)	($224.0)	($280.0)	($294.0)	($308.0)
Total Costs	60.0%	($120.0)	($240.0)	($360.0)	($480.0)	($600.0)	($630.0)	($660.0)
Pre Tax P/(L)	40.0%	$80.0	$160.0	$240.0	$320.0	$400.0	$420.0	$440.0
Tax	35.0%	($28.0)	($56.0)	($84.0)	($112.0)	($140.0)	($147.0)	($154.0)
After Tax P/(L)		$52.0	$104.0	$156.0	$208.0	$260.0	$273.0	$286.0
2. Adjustments to P/(L) to Generate Cash Flow								
Capital Investment								
Depreciation	5.0%	$1.0	$1.0	$1.0	$1.0	$1.0	$1.0	$1.0
Change in Working Capital	8.3%	($8.3)	($16.5)	($16.5)	($16.5)	($16.5)	($4.1)	($4.1)
Net Cash Flow		$44.8	$88.5	$140.5	$192.5	$244.5	$269.9	$282.9
Discount Factor	30.0%	0.1398	0.1075	0.0827	0.0636	0.0489	0.0376	0.0290
NPV		$6.3	$9.5	$11.6	$12.2	$12.0	$10.2	$8.2

		Year 15	**Year 16**	**Year 17**	**Year 18**	**Year 19**	**Year 20**	**Total**
Stage		Marketed	Marketed	Marketed	Marketed	Marketed	Marketed	
Cash Flow Analysis								
1. Income Statement								
Net Sales		$1'050.0	$1'000.0	$900.0	$800.0	$700.0	$600.0	$10'300.0
Costs								
R&D	13.0%	($136.5)	($130.0)	($117.0)	($104.0)	($91.0)	($78.0)	($1'514.0)
COGS	19.0%	($199.5)	($190.0)	($171.0)	($152.0)	($133.0)	($114.0)	($1'957.0)
Marketing, Sales G&A	28.0%	($294.0)	($280.0)	($252.0)	($224.0)	($196.0)	($168.0)	($2'884.0)
Total Costs	60.0%	($630.0)	($600.0)	($540.0)	($480.0)	($420.0)	($360.0)	($6'355.0)
Pre Tax P/(L)	40.0%	$420.0	$400.0	$360.0	$320.0	$280.0	$240.0	$3'945.0
Tax	35.0%	($147.0)	($140.0)	($126.0)	($112.0)	($98.0)	($84.0)	($1'442.0)
After Tax P/(L)		$273.0	$260.0	$234.0	$208.0	$182.0	$156.0	$2'503.0

2. Adjustments to P/(L) to Generate Cash Flow

Capital Investment								($25.0)
Depreciation	5.0%	$1.0	$1.0	$1.0	$1.0	$1.0	$1.0	
Change in Working Capital	8.3%	$4.1	$4.1	$8.3	$8.3	$8.3	$8.3	($49.5)
Net Cash Flow		$278.1	$265.1	$243.3	$217.3	$191.3	$165.3	$2'442.5
Discount Factor	30.0%	0.0223	0.0171	0.0132	0.0101	0.0078	0.0060	
NPV		$6.2	$4.5	$3.2	$2.2	$1.5	$1.0	$14.8

Figure 9 shows the NPV's of the annual cash flows at various discount rates:
Figure 9: NPV Of Cash Flows From A Typical R&D Project At Various Discount Rates



The top curve in Figure 9 corresponds to Figure 8 – i.e., a discount rate of zero. As the discount rate increases, the NPV's of the peak cash flows steadily decrease, and occur slightly earlier.

With a 3% discount rate, the NPV of the peak cash flow has decreased by a third, from $282 million to $189 million. At a 7% discount rate, the NPV of the peak cash flow has decreased by 60% to $115 million per year, while at 15%, the NPV of the peak cash flow is $49 million per year, a decrease of 82%.

Table 10 shows the NPV and payback of our project at different discount rates.

k	Net Present Value	Payback
0%	$2,443	12.21
3%	$1,571	7.85
7%	$887	4.43
12%	$382	1.91
15%	$288	1.44
30%	$15	0.07
50%	($30)	(0.15)

Table 10: NPV Of Hypothetical Drug Development Project At Different Discount Rates (S millions)

We see that the NPV goes down substantially at higher discount rates, while the payback goes down even faster. At a 30% discount rate, the NPV is only $14.8 million and the payback is only

0.07 – i.e., we only get back 7% of our investment. At a 50% discount rate, the NPV is actually negative – we've lost money.

5.9.5. Internal Rate Of Return ("IRR")

A term that is frequently encountered in NPV calculations is the Internal Rate of Return, often abbreviated to IRR.

This is a measure of the attractiveness of a project as an investment and is simply the Discount Rate required to give an NPV of zero. The higher the IRR, the more attractive the project. MS Excel makes it easy to calculate the IRR by using the "Goal Seek" function.

In the 2010 version of Excel, which I use, Goal Seek is found under the "What If Analysis" menu in the "Data" tab. To use it, click on the cell with the NPV in it, click the "Goal Seek" button and a dialogue box comes up which has three boxes. The top box will say "Set cell" and will already have the coordinates of the NPV box in it. The second box says "To value" and you enter "0". The third box says "By changing cell" and you click on the cell that has the Discount Rate in it. When you hit "Ok", the Discount Rate changes to 32.8% in the case above, so 32.8% is the IRR for the project.

The advantage of IRR as a measure of the attractiveness of a project, as opposed to the NPV is that to know whether a project with the calculated NPV is attractive, you need to know what is the size of investment that is required to achieve that NPV. A project with an NPV of $10 million that requires an investment of only $10 million is likely to be an attractive investment opportunity for a company. On the other hand, a project with the same NPV of $10 million but which requires an investment of $100 million is likely to be a much less attractive investment opportunity for the company – a lot of capital is tied up in the project and there will be little margin of error in factors such as time-to-market delays, market size misses or manufacturing cost over-runs that can be tolerated without the outcome being a negative NPV.

By contrast, IRR is neutral with respect to size of investment. A project with a 35% IRR will be a better investment opportunity for a company than a project with a 10% IRR. The only reason a company might reject the project with a 35% IRR in favor of the project with a 10% IRR is if the overall scale of the 35% project is so small that the company decides that the project can't justify the management time required to manage it – i.e., if the management opportunity cost is too high.

5.9.6. NPV Of A Typical R&D Project Of A Licensed Technology

Now, let's take another look at the 30% case we looked at in §5.9.4 above another way and assume that the drug lead wasn't developed internally but was licensed-in from another company. The cash flows in §5.9.4 above show the investment and income of the licensee, and so far we haven't provided for any license fees and royalties to the licensor.

So, yes, the NPV is only $14.8 million, but this is after a discount rate of all the cash flows – the investment and the return – of 30%. In §5.9.2.3 above we said that 30% was a common target internal investment return rate, or hurdle rate, of large companies, so without any license payments, the licensee has achieved their internal return rate of 30% and the project still has a residual NPV of $14.8 million. Therefore, the licensee could make an upfront payment of $14.8 million to the licensor, which would reduce the NPV of the project to zero and the licensee would still have achieved their 30% investment return, the licensor would have been fairly compensated, and everyone should be happy.

However, as we've discussed earlier, the licensee is unlikely to be willing to pay $14.8 million upfront, because at that stage they don't know that the project will be successful, so by making a big upfront payment they will be increasing their risk. As we saw with the Gatorade example, licensees tend to prefer back-end loaded payment terms such as a royalty on sales where they only pay the licensee if the technology is successful and enters the market. As

Table 11 shows, a royalty on sales of 6% reduces the NPV to zero20, so again all the parties should be happy. The total undiscounted royalties the licensee will receive total $617.6, taxes will total $216.1 million and the after-tax discounted value (at a 30% discount rate) is, of course, $14.8 million. In the US, universities are non-profits and are exempt from tax, so their NPV would be substantially higher.

Table 11: NPV Of Hypothetical Licensed-In Drug Development Project With Only Royalties

		Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Stage			Preclinical	Phase 1	Phase 2	Phase 3	Phase 3	NDA	Marketed
Cash Flow Analysis									
1. Income Statement									
Net Sales			$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$100.0
Costs									
R&D	13.0%		($5.0)	($10.0)	($30.0)	($50.0)	($50.0)	($30.0)	($13.0)
COGS	19.0%								($19.0)
Marketing, Sales G&A	28.0%								($28.0)
Running royalties	6.0%								($6.0)
Total Costs	66.0%		($5.0)	($10.0)	($30.0)	($50.0)	($50.0)	($30.0)	($66.0)
Pre Tax P/(L)	34.0%		($5.0)	($10.0)	($30.0)	($50.0)	($50.0)	($30.0)	$34.0
Tax	35.0%		$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	($11.9)
After Tax P/(L)			($5.0)	($10.0)	($30.0)	($50.0)	($50.0)	($30.0)	$22.1
2. Adjustments to P/(L) to Generate Cash Flow									
Capital Investment				($5.0)				($20.0)	
Depreciation	5.0%								$1.0
Change in Working Capital	8.3%								($8.3)
Net Cash Flow			($5.0)	($15.0)	($30.0)	($50.0)	($50.0)	($50.0)	$14.9
Discount Factor	30.0%								

20 The “Goal Seek” function allows the appropriate royalty rate to be calculated easily.

		1.000	0.8771	0.6747	0.5190	0.3992	0.3071	0.2362	0.1817
NPV			($4.4)	($10.1)	($15.6)	($20.0)	($15.4)	($11.8)	$2.7
Licensor's Return									
Royalties									$6.0
Tax	35.0%								($2.1)
After tax value of royalties									$3.9
Discount Factor	30.0%	1.000	0.8771	0.6747	0.5190	0.3992	0.3071	0.2362	0.1817
NPV of Royalties									$0.7

		Year 8	**Year 9**	**Year 10**	**Year 11**	**Year 12**	**Year 13**	**Year 14**
Stage		Marketed	Marketed	Marketed	Marketed	Marketed	Marketed	Marketed
Cash Flow Analysis								
1. Income Statement								
Net Sales		$200.0	$400.0	$600.0	$800.0	$1'000.0	$1'050.0	$1'100.0
Costs								
R&D	13.0%	($26.0)	($52.0)	($78.0)	($104.0)	($130.0)	($136.5)	($143.0)
COGS	19.0%	($38.0)	($76.0)	($114.0)	($152.0)	($190.0)	($199.5)	($209.0)
Marketing, Sales G&A	28.0%	($56.0)	($112.0)	($168.0)	($224.0)	($280.0)	($294.0)	($308.0)
Running royalties	6.0%	($12.0)	($24.0)	($36.0)	($48.0)	($60.0)	($63.0)	($66.0)
Total Costs	66.0%	($132.0)	($264.0)	($396.0)	($528.0)	($660.0)	($693.0)	($726.0)
Pre Tax P/(L)	34.0%	$68.0	$136.0	$204.0	$272.0	$340.0	$357.0	$374.0
Tax	35.0%	($23.8)	($47.6)	($71.4)	($95.2)	($119.0)	($125.0)	($130.9)
After Tax P/(L)		$44.2	$88.4	$132.6	$176.8	$221.0	$232.1	$243.1
2. Adjustments to P/(L) to Generate Cash Flow								
Capital Investment								
Depreciation	5.0%	$1.0	$1.0	$1.0	$1.0	$1.0	$1.0	$1.0
Change in Working Capital	8.3%	($8.3)	($16.5)	($16.5)	($16.5)	($16.5)	($4.1)	($4.1)
Net Cash Flow		$37.0	$72.9	$117.1	$161.3	$205.5	$229.0	$240.0
Discount Factor	30.0%	0.1398	0.1075	0.0827	0.0636	0.0489	0.0376	0.0290
NPV		$5.2	$7.8	$9.7	$10.3	$10.1	$8.6	$7.0
Licensor's Return								
Royalties		$12.0	$24.0	$36.0	$48.0	$60.0	$63.0	$66.0

Tax	35.0%	($4.2)	($8.4)	($12.6)	($16.8)	($21.0)	($22.0)	($23.1)
After tax value of royalties		$7.8	$15.6	$23.4	$31.2	$39.0	$40.9	$42.9
Discount Factor	30.0%	0.1398	0.1075	0.0827	0.0636	0.0489	0.0376	0.0290
NPV of Royalties		$1.1	$1.7	$1.9	$2.0	$1.9	$1.5	$1.2

		Year 15	**Year 16**	**Year 17**	**Year 18**	**Year 19**	**Year 20**	**Total**
Stage		Marketed	Marketed	Marketed	Marketed	Marketed	Marketed	
Cash Flow Analysis								
1. Income Statement								
Net Sales		$1'050.0	$1'000.0	$900.0	$800.0	$700.0	$600.0	$10'300.0
Costs								
R&D	13.0%	($136.5)	($130.0)	($117.0)	($104.0)	($91.0)	($78.0)	($1'514.0)
COGS	19.0%	($199.5)	($190.0)	($171.0)	($152.0)	($133.0)	($114.0)	($1'957.0)
Marketing, Sales G&A	28.0%	($294.0)	($280.0)	($252.0)	($224.0)	($196.0)	($168.0)	($2'884.0)
Running royalties	6.0%	($63.0)	($60.0)	($54.0)	($48.0)	($42.0)	($36.0)	($617.6)
Total Costs	66.0%	($693.0)	($660.0)	($594.0)	($528.0)	($462.0)	($396.0)	($6'972.6)
Pre Tax P/(L)	34.0%	$357.0	$340.0	$306.0	$272.0	$238.0	$204.0	$3'327.4
Tax	35.0%	($125.0)	($119.0)	($107.1)	($95.2)	($83.3)	($71.4)	($1'225.9)
After Tax P/(L)		$232.1	$221.0	$198.9	$176.8	$154.7	$132.6	$2'101.6
2. Adjustments to P/(L) to Generate Cash Flow								
Capital Investment								($25.0)
Depreciation	5.0%	$1.0	$1.0	$1.0	$1.0	$1.0	$1.0	
Change in Working Capital	8.3%	$4.1	$4.1	$8.3	$8.3	$8.3	$8.3	($49.5)
Net Cash Flow		$237.2	$226.2	$208.2	$186.1	$164.0	$141.9	$2'041.1
Discount Factor	30.0%	0.0223	0.0171	0.0132	0.0101	0.0078	0.0060	
NPV		$5.3	$3.9	$2.7	$1.9	$1.3	$0.9	($0.0)
Licensor's Return								
Royalties		$63.0	$60.0	$54.0	$48.0	$42.0	$36.0	$617.6
Tax	35.0%	($22.0)	($21.0)	($18.9)	($16.8)	($14.7)	($12.6)	($216.1)
After tax value of royalties		$40.9	$39.0	$35.1	$31.2	$27.3	$23.4	$401.4
Discount Factor	30.0%	0.0223	0.0171	0.0132	0.0101	0.0078	0.0060	
NPV of Royalties		$0.9	$0.7	$0.5	$0.3	$0.2	$0.1	$14.8

However, this is an unlikely scenario, because a totally back-end loaded deal puts all the risk on the licensor, and they are going to want to see some guaranteed return in return for giving up control of a promising drug candidate, so the combination of patent cost reimbursement, upfront fees, milestone payments, annual minimum royalties and running royalties that was presented in ¶3 above is a likely outcome and one that is fair to both sides. As shown in Table 12, because there is a $1.0 million upfront fee, $1.5 million in patent costs, milestone payments totaling $13.3 million and annual minimum royalties, all of which occur before the licensee starts generating sales, the running royalty rate has to be decreased to 4.35% to result in an NPV of $0.0 million. The total received by the licensor in undiscounted dollars after tax is $301.1 million, and the NPV is $13.6 million21.

Table 12: NPV Of Hypothetical Licensed-In Drug Development Project With Normal License Terms

		Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Stage			Preclinical	Phase 1	Phase 2	Phase 3	Phase 3	NDA	Marketed
Cash Flow Analysis									
1. Income Statement									
Net Sales			$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$100.0
Costs									
R&D	13.0%		($5.0)	($10.0)	($30.0)	($50.0)	($50.0)	($30.0)	($13.0)
COGS	19.0%								($19.0)
Marketing, Sales G&A	28.0%								($28.0)
Patent Costs		($0.25)	($0.30)	($0.20)	($0.10)	($0.10)	($0.10)	($0.10)	($0.10)
Upfront Fee		($1.00)							
AMR				($0.10)	($0.10)	($0.10)	($0.25)	($0.25)	($0.50)
Milestone Payments				($0.25)	($0.50)	($2.50)		($5.00)	($5.00)
Running royalties	4.35%								($3.85)
Total Costs	64.3%	($1.3)	($5.3)	($10.6)	($30.7)	($52.7)	($50.4)	($35.4)	($69.4)
Pre Tax P/(L)	35.7%	($1.3)	($5.3)	($10.6)	($30.7)	($52.7)	($50.4)	($35.4)	$30.6
Tax	35.0%	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	($10.7)
After Tax P/(L)		($1.3)	($5.3)	($10.6)	($30.7)	($52.7)	($50.4)	($35.4)	$19.9
2. Adjustments to P/(L) to Generate Cash Flow									

21 The reason the NPV isn't $14.8 million is that the licensor pays tax from day 1, whereas the licensee only pays tax when the P/(L) turns positive.

Capital Investment				($5.0)				($20.0)	
Depreciation	5.0%								$1.0
Change in Working Capital	8.3%								($8.3)
Net Cash Flow		($1.3)	($5.3)	($15.6)	($30.7)	($52.7)	($50.4)	($55.4)	$12.6
Discount Factor	30.0%	1.000	0.8771	0.6747	0.5190	0.3992	0.3071	0.2362	0.1817
NPV		($1.3)	($4.6)	($10.5)	($15.9)	($21.0)	($15.5)	($13.1)	$2.3

Licensor's Return

Total License Payments		$1.3	$0.3	$0.6	$0.7	$2.7	$0.4	$5.4	$9.4
Tax	35.0%	($0.4)	($0.1)	($0.2)	($0.2)	($0.9)	($0.1)	($1.9)	($3.3)
After tax value of royalties		$0.8	$0.2	$0.4	$0.5	$1.8	$0.2	$3.5	$6.1
Discount Factor	30.0%	1.000	0.8771	0.6747	0.5190	0.3992	0.3071	0.2362	0.1817
NPV of License Payments		$0.8	$0.2	$0.2	$0.2	$0.7	$0.1	$0.8	$1.1

			Year 8	**Year 9**	**Year 10**	**Year 11**	**Year 12**	**Year 13**	**Year 14**
Stage			Marketed	Marketed	Marketed	Marketed	Marketed	Marketed	Marketed
Cash Flow Analysis									
1. Income Statement									
Net Sales			$200.0	$400.0	$600.0	$800.0	$1'000.0	$1'050.0	$1'100.0
Costs									
R&D	13.0%		($26.0)	($52.0)	($78.0)	($104.0)	($130.0)	($136.5)	($143.0)
COGS	19.0%		($38.0)	($76.0)	($114.0)	($152.0)	($190.0)	($199.5)	($209.0)
Marketing, Sales G&A	28.0%		($56.0)	($112.0)	($168.0)	($224.0)	($280.0)	($294.0)	($308.0)
Patent Costs			($0.10)	($0.10)					
Upfront Fee									
AMR			($0.50)	($0.50)	($0.50)	($0.50)	($0.50)	($0.50)	($0.50)
Milestone Payments									
Running royalties	4.35%		($8.20)	($16.89)	($25.59)	($34.28)	($42.98)	($45.15)	($47.33)
Total Costs	64.3%		($128.8)	($257.5)	($386.1)	($514.8)	($643.5)	($675.7)	($707.8)
Pre Tax P/(L)	35.7%		$71.2	$142.5	$213.9	$285.2	$356.5	$374.3	$392.2
Tax	35.0%		($24.9)	($49.9)	($74.9)	($99.8)	($124.8)	($131.0)	($137.3)
After Tax P/(L)			$46.3	$92.6	$139.0	$185.4	$231.7	$243.3	$254.9

2. Adjustments to P/(L) to Generate Cash Flow

Capital Investment

Depreciation	5.0%	$1.0	$1.0	$1.0	$1.0	$1.0	$1.0	$1.0
Change in Working Capital	8.3%	($8.3)	($16.5)	($16.5)	($16.5)	($16.5)	($4.1)	($4.1)
Net Cash Flow		$39.0	$77.1	$123.5	$169.9	$216.2	$240.2	$251.8
Discount Factor	30.0%	0.1398	0.1075	0.0827	0.0636	0.0489	0.0376	0.0290
NPV		$5.5	$8.3	$10.2	$10.8	$10.6	$9.0	$7.3

Licensor's Return

Total License Payments		$8.8	$17.5	$26.1	$34.8	$43.5	$45.7	$47.8
Tax	35.0%	($3.1)	($6.1)	($9.1)	($12.2)	($15.2)	($16.0)	($16.7)
After tax value of royalties		$5.7	$11.4	$17.0	$22.6	$28.3	$29.7	$31.1
Discount Factor	30.0%	0.1398	0.1075	0.0827	0.0636	0.0489	0.0376	0.0290
NPV of License Payments		$0.8	$1.2	$1.4	$1.4	$1.4	$1.1	$0.9

		Year 15	**Year 16**	**Year 17**	**Year 18**	**Year 19**	**Year 20**	**Total**
Stage		Marketed	Marketed	Marketed	Marketed	Marketed	Marketed	
Cash Flow Analysis								
1. Income Statement								
Net Sales		$1'050.0	$1'000.0	$900.0	$800.0	$700.0	$600.0	$10'300.0
Costs								
R&D	13.0%	($136.5)	($130.0)	($117.0)	($104.0)	($91.0)	($78.0)	($1'514.0)
COGS	19.0%	($199.5)	($190.0)	($171.0)	($152.0)	($133.0)	($114.0)	($1'957.0)
Marketing, Sales G&A	28.0%	($294.0)	($280.0)	($252.0)	($224.0)	($196.0)	($168.0)	($2'884.0)
Patent Costs								($1.5)
Upfront Fee								($1.0)
AMR		($0.50)	($0.50)	($0.50)	($0.50)	($0.50)	($0.50)	($7.8)
Milestone Payments								($13.3)
Running royalties	4.35%	($45.15)	($42.98)	($38.63)	($34.28)	($29.94)	($25.59)	($440.8)
Total Costs	64.3%	($675.7)	($643.5)	($579.1)	($514.8)	($450.4)	($386.1)	($6'818.1)
Pre Tax P/(L)	35.7%	$374.3	$356.5	$320.9	$285.2	$249.6	$213.9	$3'481.9
Tax	35.0%	($131.0)	($124.8)	($112.3)	($99.8)	($87.3)	($74.9)	($1'283.4)
After Tax P/(L)		$243.3	$231.7	$208.6	$185.4	$162.2	$139.0	$2'198.5

2. Adjustments to P/(L) to Generate Cash Flow

Capital Investment								($25.0)
Depreciation	5.0%	$1.0	$1.0	$1.0	$1.0	$1.0	$1.0	
Change in Working	8.3%	$4.1	$4.1	$8.3	$8.3	$8.3	$8.3	($49.5)

Capital								
Net Cash Flow		$248.5	$236.9	$217.8	$194.6	$171.5	$148.3	$2'138.0
Discount Factor	30.0%	0.0223	0.0171	0.0132	0.0101	0.0078	0.0060	
NPV		$5.5	$4.1	$2.9	$2.0	$1.3	$0.9	($0.0)
Licensor's Return								
Total License Payments		$45.7	$43.5	$39.1	$34.8	$30.4	$26.1	$463.1
Tax	35.0%	($16.0)	($15.2)	($13.7)	($12.2)	($10.7)	($9.1)	($162.1)
After tax value of royalties		$29.7	$28.3	$25.4	$22.6	$19.8	$17.0	$301.0
Discount Factor	30.0%	0.0223	0.0171	0.0132	0.0101	0.0078	0.0060	
NPV of License Payments		$0.7	$0.5	$0.3	$0.2	$0.2	$0.1	$13.6

These three scenarios dramatically illustrate the comment made in §4.3.3 that it is generally very unwise for a licensee to take all their compensation upfront – the amount they receive will be drastically reduced because of the very high risk of failure at that stage.

Table 13: Amounts Actually Received Under Different License Payment Timing Scenarios

Payment Timing	**Undiscounted Amount Received ($ million)**
All upfront	$14.8
Upfront, progress, back-end	$463.1
All back-end	$617.6

5.9.7. Risk-Adjusted NPV ("raNPV") Or Expected NPV ("eNPV")

As we have extensively discussed, in the classical NPV approach risk is accounted for in the discount rate – the higher the risk, the higher the discount rate. When you start to use discount rates of 30% or higher, it becomes difficult to justify investing in any project that is going to take ten years or more to achieve revenues, such as drug development. Yet people continue to make these investments. Are they being economically irrational? Displaying irrational exuberance perhaps? Or do they know something that economists don't?

Some of the ways that real life differs from the simple "high discount rate" NPV approach is that:

People rarely commit all the investment to complete the project on the day the project is started; rather, investment is staged – at discrete points the project is re-evaluated and its ongoing attractiveness reassessed;
Risk is not constant over the lifetime of the project. Typically, risk – both technical risk and market risk – is progressively reduced as a project moves forward, yet the NPV approach continues to apply the same high discount rate that was appropriate in the earliest, highest risk phases of the project throughout the project's lifetime.

This realization led the author to start developing the Risk Adjusted Net Present Value ("raNPV") methodology in the early 1990's.

The key difference between the "classical" high discount rate NPV approach and the raNPV approach is that in the raNPV approach risk is accounted for explicitly, and the discount rate used is a "cost of money" (i.e., 10-15%) discount rate, not a risk-based (i.e., 30+%) discount rate.

Two investment banks which specialized in taking biotechnology companies public -- San Francisco-based Hambrecht & Quist (now part of J.P. Morgan Chase) and New York-based Lehman Brothers (of happy memory) – took initial shots at developing the raNPV approach in the very early 1990's. They took the different stages of drug development and applied arbitrary discount rates that went down progressively as the development project progressed. The discovery phase was assigned an 80% discount rate, Phase 1 testing was assigned a 50% discount rate, Phase III testing a 25% discount rate, etc. All future cash flows were discounted at the rate

appropriate to the stage the project then was at to show how the NPV changed as the project progressed. Although the projects eventually showed an attractive NPV, because of the very high discount rates applied in the early stages, the NPV was always negative in those earliest stages, so a rational business person would still have never started the project. Yet they did, so even these models didn't explain rational business decisions. And where did the 80%, 50% and 25% discount rates come from? Where was the evidence to support such rates rather than rates 25% less – 60%, 37.5% and 18.75% (or, equally likely, 25% higher – 100%, 62.5% and 31.25%)?

The key insight that allowed development of the model was the realization, as discussed in ¶2.2.2 above, that all drugs go through the same, FDA-mandated, development pathway of discovery, preclinical research, Phase 1, Phase 2 and Phase 3 testing, NDA/BLA application, combined with new data becoming available from the Center for the Study of Drug Development ("CSDD") at Tufts University. The CSDD had been founded in 1976 by Dr. Louis Lasagna, a professor of Pharmacology at the University of Rochester. In 1984, Dr. Lasagna moved to Tufts University and the Center moved with him and remains there today. Based on the respect with which Lasagna was held by the pharmaceutical industry, CSDD was able to persuade drug companies to provide detailed data on their drug development activities, including their success rates in securing drug approvals and the costs of drug development.

CSDD published a series of studies with this data, including a 1991 study which for the first time looked at the duration, cost and probability of success of each phase of drug development. This study allowed development for the first time of a data-driven probability of success model, which I first published in 199622.

The model resulted in several radical conclusions:

The NPV of drug discovery projects was significantly higher in their earliest stages than high discount rate NPV models predicted

22 "Risk Adjusted Net Present Value -- a New Approach to Valuing Early Stage Technologies" Ashley J. Stevens, Journal of Biotechnology in Healthcare, 2, 335-351, (Spring, 1996)

The greatest incremental return on investment comes from entry into Phase 1.

Previously it was thought that entry into Phase 3 was the Holy Grail of drug development. Phase 1 trials are cheap to carry out and the probability of ultimate success is very high. Phase 3 trials, by contrast, are very expensive to carry out and there is still a significant probability of failure.

The result has been a transition of biotechnology companies away from a FIPCO (Fully Integrated Pharmaceutical Company) business model, where young companies aspired to take their drugs all the way to market, as the early pioneers in biotechnology had succeeded in doing, to a RIPCO – Research Intensive Pharmaceutical Company – where young companies sought to take new drugs only as far as Phase 1 of Phase 2a and then license them out.

Biopharmaceuticals have a higher raNPV, because they have a higher probability of success.

Since my initial publication, this model has become the norm for valuation in the life sciences, because of the standardized, FDA driven approval process and the availability of data on success rates. The data have become increasingly sophisticated, with success rates for different therapeutic categories being available (infectious diseases have the highest probability of success, cardiovascular the lowest). The methodology is not applicable to ICT or engineering projects because these do not have standardized market approval pathways for which success rate data is available. A textbook on valuation in life sciences which only uses the raNPV methodology is now in its third edition23.

23 "Valuation in Life Sciences – A Practical Guide", Boris Bogdan and Ralph Villiger, Springer, 2010, ISBN 978-3-642-10819-8

Applying the raNPV methodology to our hypothetical drug development project, rather than using a 30% discount rate, we use a 12.5% discount rate and the following probabilities of success of moving from one phase to the next phase:

Stage	**Probability of Proceeding to Next Phase**	**Cumulative Probability from Preclinical**
Preclinical to Phase I[1]	50%	50.0%
Phase I to Phase II[2]	63%	31.5%
Phase II to Phase III[2]	42%	13.2%
Phase III to NDA Submission[2]	75%	9.9%
NDA Submission to NDA Approval[2]	95%	9.4%

Sources:

[1] Stevens, 1996, quoting FDA

[2] Bogdan and Villiger, 2010

Table 14 applies the raNPV approach to our hypothetical in-licensed drug development model. Using the same license terms, including the 4.35% royalty rate that resulted in a zero NPV in the 30% discount rate NPV model, the raNPV is $15.8 million. Increasing the royalty rate to 16.38% gives reduces the raNPV to zero, almost four times the royalty rate that can be justified using a traditional NPV analysis with a 30% discount rate.

Table 14: raNPV Of Hypothetical Drug Development Project With An 11% Discount Rate

	Year 0	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**
Stage		Preclinical	Phase 1	Phase 2	Phase 3	Phase 3	NDA	Marketed
Cash Flow Analysis								
1. Income Statement								
Net Sales		$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$100.0

Costs									
R&D	13.0%		($5.0)	($10.0)	($30.0)	($50.0)	($50.0)	($30.0)	($13.0)
COGS	19.0%								($19.0)
Marketing, Sales G&A	28.0%								($28.0)
Patent Costs		($0.25)	($0.30)	($0.20)	($0.10)	($0.10)	($0.10)	($0.10)	($0.10)
Upfront Fee		($1.00)							
AMR				($0.10)	($0.10)	($0.10)	($0.25)	($0.25)	($0.50)
Milestone Payments				($0.25)	($0.50)	($2.50)		($5.00)	($5.00)
Running royalties	10.00 %								($9.50)
Total Costs	70.0%	($1.3)	($5.3)	($10.6)	($30.7)	($52.7)	($50.4)	($35.4)	($75.1)
Pre Tax P/(L)	30.0%	($1.3)	($5.3)	($10.6)	($30.7)	($52.7)	($50.4)	($35.4)	$24.9
Tax	35.0%	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	($8.7)
After Tax P/(L)		($1.3)	($5.3)	($10.6)	($30.7)	($52.7)	($50.4)	($35.4)	$16.2

2. Adjustments to P/(L) to Generate Cash Flow

Capital Investment				($5.0)				($20.0)	
Depreciation	5.0%								$1.0
Change in Working Capital	8.3%								($8.3)
Net Cash Flow		($1.3)	($5.3)	($15.6)	($30.7)	($52.7)	($50.4)	($55.4)	$8.9

Stage			Preclinical	Phase 1	Phase 2	Phase 3	Phase 3	NDA	
Probability of Success		100%	100%	50%	63%	42%	75%	95%	100%
Cumulative POS		100%	100%	50%	31.5%	13.2%	9.9%	9.4%	9.4%
Discount Factor	12.5%	1.000	0.9428	0.8381	0.7449	0.6622	0.5886	0.5232	0.4651
raNPV		($1.3)	($5.0)	($6.5)	($7.2)	($4.6)	($2.9)	($2.7)	$0.4
NPV		($1.3)	($5.0)	($13.0)	($22.9)	($34.9)	($29.6)	($29.0)	$4.2

Licensor's Return

Total License Payments		$1.3	$0.3	$0.6	$0.7	$2.7	$0.4	$5.4	$15.1
Tax	35.0%	($0.4)	($0.1)	($0.2)	($0.2)	($0.9)	($0.1)	($1.9)	($5.3)
After tax value of royalties		$0.8	$0.2	$0.4	$0.5	$1.8	$0.2	$3.5	$9.8

Stage			Preclinical	Phase 1	Phase 2	Phase 3	Phase 3	NDA	
Probability of Success		100%	100%	50%	63%	42%	75%	95%	100%
Cumulative POS		100%	100%	50%	31.5%	13.2%	9.9%	9.4%	9.4%
Discount Factor	12.5%	1.000	0.9428	0.8381	0.7449	0.6622	0.5886	0.5232	0.4651
raNPV of License Payments		$0.8	$0.2	$0.1	$0.1	$0.2	$0.0	$0.2	$0.4
NPV		$0.8	$0.2	$0.3	$0.3	$1.2	$0.1	$1.8	$4.6
			Year 8	**Year 9**	**Year 10**	**Year 11**	**Year 12**	**Year 13**	**Year 14**

Stage		Marketed	Marketed	Marketed	Marketed	Marketed	Marketed	Marketed
Cash Flow Analysis								
1. Income Statement								
Net Sales		$200.0	$400.0	$600.0	$800.0	$1'000.0	$1'050.0	$1'100.0
Costs								
R&D	13.0%	($26.0)	($52.0)	($78.0)	($104.0)	($130.0)	($136.5)	($143.0)
COGS	19.0%	($38.0)	($76.0)	($114.0)	($152.0)	($190.0)	($199.5)	($209.0)
Marketing, Sales G&A	28.0%	($56.0)	($112.0)	($168.0)	($224.0)	($280.0)	($294.0)	($308.0)
Patent Costs		($0.10)	($0.10)					
Upfront Fee								
AMR		($0.50)	($0.50)	($0.50)	($0.50)	($0.50)	($0.50)	($0.50)
Milestone Payments								
Running royalties	10.00 %	($19.50)	($39.50)	($59.50)	($79.50)	($99.50)	($104.50)	($109.50)
Total Costs	70.0%	($140.1)	($280.1)	($420.0)	($560.0)	($700.0)	($735.0)	($770.0)
Pre Tax P/(L)	30.0%	$59.9	$119.9	$180.0	$240.0	$300.0	$315.0	$330.0
Tax	35.0%	($21.0)	($42.0)	($63.0)	($84.0)	($105.0)	($110.3)	($115.5)
After Tax P/(L)		$38.9	$77.9	$117.0	$156.0	$195.0	$204.8	$214.5
2. Adjustments to P/(L) to Generate Cash Flow								
Capital Investment								
Depreciation	5.0%	$1.0	$1.0	$1.0	$1.0	$1.0	$1.0	$1.0
Change in Working Capital	8.3%	($8.3)	($16.5)	($16.5)	($16.5)	($16.5)	($4.1)	($4.1)
Net Cash Flow		$31.7	$62.4	$101.5	$140.5	$179.5	$201.6	$211.4

Stage								
Probability of Success		100%	100%	100%	100%	100%	100%	100%
Cumulative POS		9.4%	9.4%	9.4%	9.4%	9.4%	9.4%	9.4%
Discount Factor	12.5%	0.4134	0.3675	0.3266	0.2903	0.2581	0.2294	0.2039
raNPV		$1.2	$2.2	$3.1	$3.8	$4.4	$4.4	$4.1
NPV		$13.1	$22.9	$33.2	$40.8	$46.3	$46.3	$43.1
Licensor's Return								
Total License Payments		$20.1	$40.1	$60.0	$80.0	$100.0	$105.0	$110.0
Tax	35.0%	($7.0)	($14.0)	($21.0)	($28.0)	($35.0)	($36.8)	($38.5)
After tax value of royalties		$13.1	$26.1	$39.0	$52.0	$65.0	$68.3	$71.5

Stage								
Probability of Success		100%	100%	100%	100%	100%	100%	100%

Cumulative POS		9.4%	9.4%	9.4%	9.4%	9.4%	9.4%	9.4%
Discount Factor	12.5%	0.4134	0.3675	0.3266	0.2903	0.2581	0.2294	0.2039
raNPV of License Payments		$0.5	$0.9	$1.2	$1.4	$1.6	$1.5	$1.4
NPV		$5.4	$9.6	$12.7	$15.1	$16.8	$15.7	$14.6

		Year 15	**Year 16**	**Year 17**	**Year 18**	**Year 19**	**Year 20**	**Total**
Stage		Marketed	Marketed	Marketed	Marketed	Marketed	Marketed	
Cash Flow Analysis								
1. Income Statement								
Net Sales		$1'050.0	$1'000.0	$900.0	$800.0	$700.0	$600.0	$10'300.0
Costs								
R&D	13.0%	($136.5)	($130.0)	($117.0)	($104.0)	($91.0)	($78.0)	($1'514.0)
COGS	19.0%	($199.5)	($190.0)	($171.0)	($152.0)	($133.0)	($114.0)	($1'957.0)
Marketing, Sales G&A	28.0%	($294.0)	($280.0)	($252.0)	($224.0)	($196.0)	($168.0)	($2'884.0)
Patent Costs								($1.5)
Upfront Fee								($1.0)
AMR		($0.50)	($0.50)	($0.50)	($0.50)	($0.50)	($0.50)	($7.8)
Milestone Payments								($13.3)
Running royalties	10.00 %	($104.50)	($99.50)	($89.50)	($79.50)	($69.50)	($59.50)	($1'023.0)
Total Costs	70.0%	($735.0)	($700.0)	($630.0)	($560.0)	($490.0)	($420.0)	($7'400.3)
Pre Tax P/(L)	30.0%	$315.0	$300.0	$270.0	$240.0	$210.0	$180.0	$2'899.8
Tax	35.0%	($110.3)	($105.0)	($94.5)	($84.0)	($73.5)	($63.0)	($1'079.6)
After Tax P/(L)		$204.8	$195.0	$175.5	$156.0	$136.5	$117.0	$1'820.1
2. Adjustments to P/(L) to Generate Cash Flow								
Capital Investment								($25.0)
Depreciation	5.0%	$1.0	$1.0	$1.0	$1.0	$1.0	$1.0	
Change in Working Capital	8.3%	$4.1	$4.1	$8.3	$8.3	$8.3	$8.3	($49.5)
Net Cash Flow		$209.9	$200.1	$184.8	$165.3	$145.8	$126.3	$1'759.6
Stage								
Probability of Success		100%	100%	100%	100%	100%	100%	
Cumulative POS		9.4%	9.4%	9.4%	9.4%	9.4%	9.4%	
Discount Factor	12.5%	0.1813	0.1611	0.1432	0.1273	0.1132	0.1006	
raNPV		$3.6	$3.0	$2.5	$2.0	$1.6	$1.2	$8.4
NPV		$38.0	$32.2	$26.5	$21.0	$16.5	$12.7	$262.4

Licensor's Return

Total License Payments		$105.0	$100.0	$90.0	$80.0	$70.0	$60.0	$1'045.3
Tax	35.0%	($36.8)	($35.0)	($31.5)	($28.0)	($24.5)	($21.0)	($365.8)
After tax value of royalties		$68.3	$65.0	$58.5	$52.0	$45.5	$39.0	$679.4
Stage								
Probability of Success		100%	100%	100%	100%	100%	100%	
Cumulative POS		9.4%	9.4%	9.4%	9.4%	9.4%	9.4%	
Discount Factor	12.5%	0.1813	0.1611	0.1432	0.1273	0.1132	0.1006	
raNPV of License Payments		$1.2	$1.0	$0.8	$0.6	$0.5	$0.4	$14.1
NPV		$12.4	$10.5	$8.4	$6.6	$5.1	$3.9	$145.2

When pharmaceutical companies analyze proposed licensing transactions, they generally calculate an NPV using their WACC discount rate – typically 11%-12.5% -- and then also calculate an raNPV/eNPV. They then look at the distribution of the NPV between themselves and the Licensor. There will be a significant difference between the NPV and raNPV/eNPV splits between the two approaches. Taking our hypothetical drug development project, with a 12.5% discount rate and a 10% running royalty rate, our license terms result in an NPV of $262.4 million, which becomes $8.4 million on a risk adjusted basis. The NPV of the license payments is $145.2 million so the licensor is receiving 35.6% of the total, while the licensee receives 64.4%. However, of the raNPV, only $8.4 million or 37.3% goes to the licensee, while 62.7% goes to the licensee. The reason for this big difference is that the licensor receives substantial payments early in the development process when the probability of success is higher.

5.9.8. Where Do You Get the Data?

Generating the data is tough. An obvious place to turn to is the licensee. Ask them for their projections – but be sure to insist that they provide you with the analyses that they presented to their Board. Then, in the immortal words of Ronald Regan, “Trust but Verify”. Double check their patient number figures, look at the price of competitive drugs, look at their operating cost percentages and compare with others in the industry, and so forth.

5.9.9. Valuate®

There is a short cut you can use to building NPV models called Valuate®. Valuate® is a system first created in 1993 by Martha Luerhman, who was in the TLO of the U. of California Berkeley, and most recently updated in 2000. Martha has dedicated it to the public and it is available on the AUTM website, though it is buried fairly deeply. As of March 2013, the navigation to find it on the AUTM website is:

About ➔ About Technology Transfer ➔ Technology Transfer Resources

It can also be found through the website's search engine.

All the resources under "Technology Transfer Resources" – Principles and Guidelines, Initiatives and Partnerships, Laws and Regulations, Materials Transfer Agreements and Research Tools, Sample Agreements & Policies, as well as Valuation Resources – are available to non-AUTM members.

At the bottom of the list of resources are links to three downloads:

Valuate Manual (pdf)

Valuate 2000 (Excel)

ValBio 2000 (Excel)

The manual gives a good tutorial. The system is based on the 25% rule, but the spreadsheets make one very big mistake – Martha takes as her royalty rate 25% of the gross profit margin, not the pre-tax profit margin after all operating expenses have been deducted. She therefore starts off with extraordinarily high royalty rates – 23% in ValBio 2000, the pharmaceutical spreadsheet, based on a typical 95% gross margin for small molecule drugs, and 10% in Valuate 2000, the "all other" spreadsheet. You can change these as described below.

Valuate uses the Risk Adjusted Net Present Value methodology.

Valuate 2000 has six linked spreadsheets. You enter the assumptions about the business, the license terms and the discount rates in the first three worksheets. The next three worksheets show the overall financials for the project, s set of sensitivity analyses and the company's cash flow.

ValBio 2000 has five linked worksheets. All of the business and license term assumptions are entered in the first worksheet. The next three worksheets show the overall financials for the project, a set of sensitivity analyses and the company's cash flow.

5.9.10. Benefits And Limitations Of An NPV-Based Valuation

Benefits	Limitations
• Trades off near term and long term financial terms appropriately	• Quality depends critically on the quality of the data
	• Critical data may not be available for technologies at a very early stage.
	• Susceptible to "Garbage in-Garbage out" issues

5.10. Monte Carlo Methods

5.10.1. Description

Monte Carlo methods are another approach to accounting for risk.

Both the NPV and raNPV approaches require the analyst to make assumptions about all the parameters of the project – its costs, its revenues, the probability of success for each phase in the raNPV approach, etc. – and then generate a single number that represents the analyst's best estimate of the present value of the project.

Monte Carlo methods, by contrast, allow the analyst to put ranges round the various parameters, allowing, say for cost over-runs in development and for the possibility that sales may be either higher of lower than expected. The NPV is then calculated for each combination of the estimated parameters, and the results are presented as a distribution of the probability of the NPV.

Such an approach is obviously computationally very intensive, and laborious if done manually, but there are software packages that will do the work for you that operate as "plug ins" to Excel. The leading products are:

Crystal Ball®, originally developed by Hyperion, which was acquired by Oracle in 2007. The package is expensive, listing at $995 currently.

@Risk by Palisades. This costs even more -- $2,395 as part of a bundle of decision-making products.

Most companies have academic packages, some even free, to encourage people to use the product in their student days.

5.10.2. Benefits And Limitations Of A Monte-Carlo-Based Valuation

Benefits	Limitations
• Gives much more sophisticated analysis of risk than NPV or raNPV approaches	• Data unlikely to be available for early stage academic technologies

5.11. Equity

5.11.1. Description

As discussed in Section 2.1 above, sometimes, particularly when licensing to a brand new start-up, a licensor will take part of their compensation, particularly the upfront consideration, in equity.

The operative words here are "part of their consideration". Normally, the equity received is only in lieu of an upfront fee in cash, though it may be appropriate to allow the company to pay early milestone payments in stock. Normal milestone, annual minimum royalty and running royalty terms should be included. As discussed in §2.2.5.2, the percentage of pre-commercialization payments received from sublicensees may be lower than in non-equity situations.

The valuation question is: "How does the licensor determine the value of the company's equity and hence know how much to negotiate for?"

This section looks at the capital structure of a start-up and how it changes with time – how the raising of capital and the hiring of new employees and how these impact how the fruits of success will be divided between the licensor, Founders, management and investors. This is captured in the company's Capitalization Table ("Cap Table"), which constantly changes as the company grows and develops.

Companies manage their capital structure, particularly the stock ownership of Founders and employees in order to minimize their tax liabilities, particularly in the early days when the company is privately held and there is no market for the shares. This entire section 5.11 is written based on the tax laws of the United States and different considerations may apply in other jurisdictions.

Some of these principles are:

All purchases of shares are made at fair market value, so that no tax is due on an imputed cash value. The consequence of this is that generally only Founders and employees who join the company before its first raising of capital can afford to buy shares in the company because after the company raises capital its shares have a significant value; later arrivals receive options to buy shares at the current price for some period into the future;

In many countries, taxes on capital gains are generally lower than taxes on ordinary income, in order to incentivize capital formation. Options are structured to allow their owners to receive capital gains treatment for their profits when they exercise the option and buy the underlying shares.

5.11.1.1. Founders Stock And The Founders' Round

Founders stock is just the first common stock issued by a new company. When a company is first incorporated, it has no assets and hence very little value, so the Founders' stock is generally sold at its par value (a nominal value printed on the share certificates) of 1¢ or even 0.1¢ per share. The Founders of the company will buy the stock from the company in the percentages they've agreed that each would own of the company. Despite the low price, if, say, 10 million shares were issued to the Founders at 0.1¢, the proceeds to the company would be $10,000, enough to pay the initial legal fees to incorporate the company, set up employment agreements with the Founders, etc.

The Founders are free to agree on any distribution of ownership they wish. An approach that will maximize teamwork and camaraderie will be to have equal shares, but there may be significant differences in contribution (e.g., assigning IP to the company, providing initial operating funds, etc.), experience, employment circumstances, duration of their planned employment with the company, and so forth that might dictate a different arrangement.

Many companies are incorporated in Delaware, even if their operations are initially going to be in one of the other 50 states, because of the favorable body of corporate law in Delaware. Venture capitalists will normally insist that companies they are going to invest in be incorporated in Delaware (or Nevada for a West Coast-based company), so it's not a bad plan to incorporate there initially.

One of the quirks of Delaware law is that a company's state taxes depend in part on the number of shares the company has issued and outstanding. In order to minimize the tax bite in the early days of a company, entrepreneurs frequently issue a relatively small number of shares initially and then split them when it is time to raise financing.

All employees who receive stock in a company, but particularly the Founders because of the large amount of stock they receive, should be required to "earn in" their stock by maintaining their employment with the company for a defined period. Four years is a typical vesting period for Founder/employee stock, with perhaps 5 or 10% vesting immediately and the rest vesting in equal amounts on the annual (or sometimes monthly) anniversary of the employment agreement. That said, in order to optimize the tax treatment of their stock, the Founders will normally buy all their stock upfront at par value and the company will have the right to buy the stock back at the same price the Founders paid, with the number of shares subject to this buy back decreasing proportionately on the same anniversaries. This is called an 83(b) election. A Founder who is irrevocably assigning intellectual property to the company may be exempted from part or all of the earn-in/buy back requirement.

We will use as an example a university spin-out company, founded by:

- A professor, who is not planning on leaving the university and joining the company, but who will chair the Scientific Advisory Board and consult for the company for the one day per week that academic employment contracts generally permit;

- Two post-doctoral fellows who worked on the technology in the professor's laboratory, are co-inventors with the professor on the patent applications the university filed on the technology, and who will join the company as respectively Chief Scientific Officer and Chief Technology Officer;

- A CEO, who has resigned from a position as Vice President for Business Development at a major pharmaceutical company; and

- The University, which, while not actually a founder of the company, has agreed to exclusively license the professor's technology to the company and has agreed to accept Founders' stock in lieu of a cash license fee.

The Founders agree that the professor will get 20%, the CEO 40%, the postdocs 10% each and the university 20% of the Founders' stock. The company is incorporated in Delaware, so the company just sells a total of 10,000 shares to the Founders, at a par value of $1/share.

The Cap Table of the company at the end of the Founders' Round is shown in Table 15:

Table 15 Cap Table After Founders' Round

Price per Share	**$1.00**			
	Shares	**Raised**	**%**	**Value**
Professor	**2'000**	**$2'000**	**20%**	**$2'000**
Postdoc A	**1'000**	**$1'000**	**10%**	**$1'000**
Postdoc B	**1'000**	**$1'000**	**10%**	**$1'000**
University	**2'000**	**$2'000**	**20%**	**$2'000**
CEO	**4'000**	**$4'000**	**40%**	**$4'000**
Total	**10'000**	**$10'000**	**100%**	**$10'000**

Issued and outstanding	**10'000**
Fully diluted	**10'000**
Raised in this round	**$10'000**
Cumulative raised	**$10'000**

We'll follow the value of the university's share. The university owns 20% of the company and its stake is valued at what it paid for it, $1,000. In other words, at this stage the technology has a negative value to the university – it had to pay $1,000 to acquire the shares in the company.

5.11.1.2. The Seed Round

The management team agrees that they need to do some proof-of-concept experiments before the company can approach venture capitalists for a major financing. They decide to approach their friends and family, plus the CEO will invest. They decide they need to raise $200,000 to do this work.

First, they split the shares 250 for 1, so the university now has 500,000 shares and everyone else is increased proportionately. The company now has a total of 2.5 million shares issued and outstanding.

The company decides to sell 250,000 shares at $0.80/share, raising $200,000.

The Cap Table after the Seed Round is shown in Table 16:

Table 16 Cap Table After The Seed Round

Price per Share	**$0.80**			
Split	**250**	**for 1**		
	Shares	**Raised**	**%**	**Value**

Professor	**500'000**		**18.2%**	**$400'000**
Postdoc A	**250'000**		**9.1%**	**$200'000**
Postdoc B	**250'000**		**9.1%**	**$200'000**
University	**500'000**		**18.2%**	**$400'000**
CEO	**1'000'000**		**36.4%**	**$800'000**
Seed investors	**250'000**	**$200'000**	**9.1%**	**$200'000**
Total	**2'750'000**	**$200'000**	**100.0%**	**$2'200'000**

Issued and outstanding	**2'750'000**
Fully diluted	**2'750'000**
Raised in this round	**$200'000**
Cumulative raised	**$210'000**
Pre-Money	**$2'000'000**
Post-Money	**$2'200'000**

The Founders are all diluted by about 10%, so the university now owns 18.2% of the company and the seed investors own 9.1% of the company. However, the value of the university's stake has gone from $2,000 to $400,000.

The value of the company before the financing (the "Pre-Money Value") was $2 million (2.5 million shares each worth $0.80/share), while the value of the company after the financing (the "Post-Money Value") is $2.2 million (the $2 million Pre-Money Value plus the $200,000 raised).

In fact, the company probably wouldn't actually issue shares to the seed investors, but would issue Convertible Notes, in which it borrowed the money and promised to repay it, or if certain conditions were met, such as the raising of a Series A Round within a specified time period, to issue shares instead of repaying in cash. The company and the investors probably wouldn't have even agreed on the price of the shares, but rather would have agreed to leave that to be decided by the Series A Round investors, with the price of the Seed Round shares being less than the Series A shares. Our Seed Round investors agree to a 20% discount to the Series A, which is a common level of discount, which will give them a 25% profit when the Series A Round is raised.

5.11.1.3. Series A Venture Financing

The proof-of-concept experiments funded by the Seed Round are successful and the company decides it is now ready raise its Series A financing. It decides it needs to raise $3 million to develop its initial product. Two venture funds agree to invest $1.5 million each by buying 1.5 million shares at $1.0/share. They are not prepared to buy Common Stock but insist on buying a new class of shares, Participating Convertible Preferred Shares. These shares have certain privileges that make them worth more than the Common Shares and give the investors a large measure of control over the company.

The new investors agree to allow the company to issue 1 million shares of Common Stock into an Option Pool that will issue stock options to new employees that will be hired and paid from the Series A financing, to ensure that the new employees have a financial incentive to see the company succeed. An option gives someone the right to buy a certain number of shares at a fixed price for some period into the future. If the value of the shares increases in the future, the option holder can exercise the option, sell the shares and pocket the difference between the option exercise price and the market price.

After a company has started raising money, its shares are now worth more than the nominal value the Founders paid, and new employees are issued options, not shares because if they were issued shares they would have to pay ordinary income tax on the value of the shares in the year they received them, with no immediate way of selling any of the shares to raise the money to pay the IRS. An option allows them to get all the benefits if the company is successful without any of the risk if the company is unsuccessful and its shares never achieve any value.

The Cap Table after the Series A financing is shown in Table 17:

Table 17 Cap Table after The Series A Financing

Price per Share	**$1.00**

	Shares			Raised	%		Value
	Common		Series A		I&O	FD	
	Shares	Options					
Professor	500'000				8.7%	7.4%	$500'000
Postdoc A	250'000				4.3%	3.7%	$250'000
Postdoc B	250'000				4.3%	3.7%	$250'000
University	500'000				8.7%	7.4%	$500'000
CEO	1'000'000				17.4%	14.8%	$1'000'000
Seed investors	250'000				4.3%	3.7%	$250'000
Management Pool		1'000'000				14.8%	$1'000'000
VC Fund A			1'500'000	$1'500'000	26.1%	22.2%	$1'500'000
VC Fund B			1'500'000	$1'500'000	26.1%	22.2%	$1'500'000
Total	2'750'000	1'000'000	3'000'000	$3'000'000	100.0%	100.0%	$6'750'000

Issued and outstanding	5'750'000
Fully diluted	6'750'000
Raised in this round	$3'000'000
Cumulative raised	$3'210'000
Pre-Money	$3'750'000
Post-Money	$6'750'000

The various shareholders' ownership share of the company now depends on whether you include the Option Pool or not. The VC's own 52.2% of the shares that are Issued and Outstanding, a majority, though this will go down to 44.4% when all the Options are exercised, i.e. on a Fully Diluted basis. The university's ownership share of the company has gone down from 18.2% after the Seed Round to 8.7% of the shares that are Issued and Outstanding and to 7.4% on a Fully Diluted basis. However, the value of the university's shares has gone up a further 25%, to $500,000.

The Pre-Money value of the company was $3.75 million, while the Post-Money value is $6.75 million.

5.11.1.4. Series B Financing

With its product successfully developed and tested and its value proposition supported by hard facts, the company is ready to gear up to manufacture, launch and sell its first product. These are expensive activities, and the company decides it needs to raise $10 million, and because of the great data from testing the product, it is able to justify a doubling of the share price, to $2/share. The two existing VC's would be happy to put in all the money, but if they did, under the rules of the National Venture Capital Association, they wouldn't be able to write up the value of their Series A shares to the new, higher share price. However, if a new investor leads the round and agrees to the new, higher price, then they can show an unrealized increase in the value of their earlier investment, which will keep their Limited Partners happy and help the partnerships raise their next investment funds.

So they find Venture Fund C, which agrees to invest 40% of the round, and Funds A and B each invest 30% of the new round. Fund C insists on a new class of stock, Series B Participating Convertible Preferred shares. The various preferences of the Series B shares take precedence over those of the Series A shares – the most recent money always takes priority over the previous investments. At $2/share, the company has to sell 5 million shares to raise $10 million. Nearly all the 1 million options in the original option pool have been granted to new employees, so the VC's authorize issuance of a further 1 million shares to the Option Pool so that the company can issue options to the next group of employees who'll be hired

The Cap Table after the Series B round is shown in Table 18:

Table 18 Cap Table After The Series B Round

Price per Share	**$2.00**							
	Shares				**Raised**	**%**		**Value**
	Common		**Series A**	**Series B**		**I&O**	**FD**	
	Shares	**Options**						
Professor	**500'000**					**4.7%**	**3.9%**	**$1'000'000**
Postdoc A	**250'000**					**2.3%**	**2.0%**	**$500'000**

Postdoc B	**250'000**					**2.3%**	**2.0%**	**$500'000**
University	**500'000**					**4.7%**	**3.9%**	**$1'000'000**
CEO	**1'000'000**					**9.3%**	**7.8%**	**$2'000'000**
Seed investors	**250'000**					**2.3%**	**2.0%**	**$500'000**
Management Pool		**2'000'000**					**15.7%**	**$4'000'000**
VC Fund A			**1'500'000**	**1'500'000**	**$3'000'000**	**27.9%**	**23.5%**	**$6'000'000**
VC Fund B			**1'500'000**	**1'500'000**	**$3'000'000**	**27.9%**	**23.5%**	**$6'000'000**
VC Fund C				**2'000'000**	**$4'000'000**	**18.6%**	**15.7%**	**$4'000'000**
Total	**2'750'000**	**2'000'000**	**3'000'000**	**5'000'000**	**$10'000'000**	**100%**	**100%**	**$25'500'000**
Issued and outstanding	**10'750'000**							
Fully diluted	**12'750'000**							
Raised in this round	**$10'000'000**							
Cumulative raised	**$13'210'000**							
Pre-Money	**$15'500'000**							
Post-Money	**$25'500'000**							

The VC's now own 71.8% of the company on an Issued and Outstanding basis and 59.6% on a Fully Diluted basis. The university's share is down to 5.1% on an Issued and Outstanding basis and 4.3% on a Fully Diluted basis but the value of its shares has increased to $1 million. The Pre-Money valuation for the round was $13.5 million and the Post-Money value is $23.5 million.

5.11.1.5. Initial Public Offering

The initial sales of the company's first product are going extremely well, so the Company decides it is ready to file for an Initial Public Offering, or IPO[24]. It finds an Investment Banker who feels it can underwrite a sale of 8 million shares to the public at $8/share. Immediately before the

24 In reality, it is highly unlikely that the company will be able to go public after raising and investing so little. However, we will learn nothing new by going through Series C, D, E etc. rounds of VC financing, except that we would see founders and management getting diluted to the stage that the investors may start to give them options to get their shareholdings back up. VC's like to see the CEO not drop below 5% and the other "C" level members of the management team stay around 2% by the time of the Exit, whether by IPO or acquisition.

public offering, all the shares of Series A and B Participating Convertible Preferred shares are converted into Common shares, and the holders of the options all exercise their options so that they will be able to sell the shares and obtain Long Term Capital Gains tax treatment of their profits.

The Cap Table now looks very different, as shown in Table 19. There is only a single class of stock and all the options have been exercised.

Table 19 Cap Table after the Initial Public Offering

Price per Share	**$8.00**				
	Shares Common Shares	**Raised**	**% I&O**	**FD**	**Value**

Professor	**500'000**		**2.4%**	**2.4%**	**$4'000'000**
Postdoc A	**250'000**		**1.2%**	**1.2%**	**$2'000'000**
Postdoc B	**250'000**		**1.2%**	**1.2%**	**$2'000'000**
University	**500'000**		**2.4%**	**2.4%**	**$4'000'000**
CEO	**1'000'000**		**4.8%**	**4.8%**	**$8'000'000**
Seed investors	**250'000**		**1.2%**	**1.2%**	**$2'000'000**
Management Pool	**2'000'000**		**9.6%**	**9.6%**	**$16'000'000**
VC Fund A	**3'000'000**		**14.5%**	**14.5%**	**$24'000'000**
VC Fund B	**3'000'000**		**14.5%**	**14.5%**	**$24'000'000**
VC Fund C	**2'000'000**		**9.6%**	**9.6%**	**$16'000'000**
Public Investors	**8'000'000**	**$64'000'000**	**38.6%**	**38.6%**	**$64'000'000**
Total	**20'750'000**	**$64'000'000**	**100%**	**100%**	**$166'000'000**

Issued and outstanding	**20'750'000**
Fully diluted	**20'750'000**
Raised in this round	**$64'000'000**
Cumulative raised	**$77'210'000**
Pre-Money	**$102'000'000**
Post-Money	**$166'000'000**

The public shareholders now own 40.5% of the company, the VC investors own 35.4%, the Seed Investors own 1.3% and the Founders and Management own 22.8%. There is only a single class of stock, Common Stock.

The $12 million invested by the 3 VC funds in the Series A and B rounds has increased to $56 million, with VC funds A and B showing a 5x return on the $4 million they each invested in the Series A and B rounds and VC fund C showing a 4x return on the $4 million it invested in the Series B round. The university's ownership of the company is down to 2.5% of the company, but its shares are now worth $4 million.

5.11.1.6. Life After The IPO

The VC's, Founders, employees and the university can't sell their shares immediately. First, the Underwriters will have imposed a "Lock-Up" of 6 months, during which none of the existing shareholders can sell their stock, to allow an orderly market for the company's shares to develop.

Second, the existing shareholders own unregistered shares – shares that have not been registered with the SEC. Only the public shareholders own registered stock at this stage and can sell it freely, and before the existing shareholders can sell their shares, the shares need to be registered with the SEC. The VC's will have included the right to do this in their preferences, and hopefully management has negotiated "Tag Along" rights so that they can register some or all of their shares at the same time as the VC's register theirs.

That said, a small amount of shares can be sold under Rule 144, the amount being related to the daily trading volume of the company's publicly traded shares.

5.11.1.7. Acquisition

An attractive alternative to an IPO is to sell the company to another, bigger company. The acquisition will either be paid for in cash or in shares of the acquiring company's stock, if the company is already publicly traded. Acquisition is attractive because (a) there is immediate liquidity because the purchase price is either paid in cash or through registered shares of the acquiring company (b) there is no "lock up", and (c) an IPO is an expensive undertaking, and the underwriter commissions and legal and accounting fees will typically consume at least 10% of the funds raised.

However, from the management and Founders' viewpoint there is a downside to an acquisition – liquidation preferences. Typically, if the company is acquired, the preferred investors will first receive their investment, and sometimes a multiple of their investment, out of the purchase price, and the balance will be distributed among all the shareholders, including the preferred shareholders, according to their shareholdings. In other words, the preferred shareholders get a "double dip".

So, our company accepts an acquisition offer at $7.20/share, 10% below the IPO share price, with both the Series A and the Series B round investors having agreed a 1x liquidation preference as

part of their original investments – i.e., they will get their original investment back off the top and then get their ownership percentages of the balance of the proceeds.

The Cap Table and how the proceeds stack up are shown in

Table 20, together with how the players fare compared with the value created in the IPO (i.e., assuming that all the shares are ultimately sold at the IPO price).

Table 20 Cap Table after an Acquisition

Acquisition	$91'800'000											
Per share	$7.2											
Liquid. Pref.				Price								
Series A	1	x	fr.	1.00								
Series B	1	x	fr.	2.00								
	Shares					%		Proceeds				
	Common		Series A	Series B	I&O	FD	Preferences	Balance	Total	IPO	D	%
	Shares	Options										
Professor	500'000				4.7%	3.9%		$3'090'196	$3'090'196	$4'000'000	($909'804)	77.3%
Postdoc A	250'000				2.3%	2.0%		$1'545'098	$1'545'098	$2'000'000	($454'902)	77.3%
Postdoc B	250'000				2.3%	2.0%		$1'545'098	$1'545'098	$2'000'000	($454'902)	77.3%
University	500'000				4.7%	3.9%		$3'090'196	$3'090'196	$4'000'000	($909'804)	77.3%
CEO	1'000'000				9.3%	7.8%		$6'180'392	$6'180'392	$8'000'000	($1'819'608)	77.3%
Seed invest	250'000				2.3%	2.0%		$1'545'098	$1'545'098	$2'000'000	($454'902)	77.3%
Mgmt Pool		2'000'000				15.7%		$12'360'784	$12'360'784	$16'000'000	($3'639'216)	77.3%
VC Fund A			1'500'000	1'500'000	27.9%	23.5%	$4'500'000	$18'541'176	$23'041'176	$24'000'000	($958'824)	96.0%
VC Fund B			1'500'000	1'500'000	27.9%	23.5%	$4'500'000	$18'541'176	$23'041'176	$24'000'000	($958'824)	96.0%
VC Fund C				2'000'000	18.6%	15.7%	$4'000'000	$12'360'784	$16'360'784	$16'000'000	$360'784	102.3%
Total	2'750'000	2'000'000	3'000'000	5'000'000	100%	100%	$13'000'000	$78'800'000	$91'800'000	$102'000'000	($10'200'000)	90.0%
Issued & O	10'750'000											
Fully Dilut	12'750'000											

The comparison column shows that the holders of Common stock receive 77.2% of the amount they would have received in the IPO, while venture funds A and B receive 97.2% and venture fund C comes out ahead, receiving 102.2% of the IPO amount. The Common stock holders are hit by both the reduced sale price and the preferences. For venture funds A and B, the preferences almost compensate for the reduced per share price, while for venture fund C, since they only

invested in Series B at the higher per share price, the preferences on that more than compensates for the reduced per share price.

Now, in reality the net proceeds to the company from an IPO at $8/share and an acquisition at $7.20/share are actually likely to be pretty similar – Underwriters' commissions are likely to be 7-8% of the proceeds, and the legal costs of an IPO, particularly after the Sarbanes-Oxley Act, and interacting with the SEC will be substantially higher than for an acquisition, so in reality the Common shareholders would get 85.5% of what they would have got in the IPO, the amount they lose to the preferences, while all of the VC's come out ahead, VC's A and B getting 108% and VC C receiving 113.6% of the IPO amount.

5.11.1.8. The Dark Side – Down Rounds

Now let's see what happens when all does not go well for the company. Let's assume they don't make the technical progress they committed to their Series A investors they with the Series A financing, and are in serious danger of running out of money. In these circumstances, they won't be able to bring a new investor on board, and the round will be just with venture funds A and B. Venture funds A and B are not happy. They still think the company is going to be successful, and are willing to put in more funds, but they extract their revenge. The company is still going to need $10 million to gear up to get to market, but it needs a further $1 million to cover the unexpected difficulties it has encountered in developing the lead product.

Venture funds A and B agree to invest the $11 million25, but instead of agreeing a $2/share price, they refuse to pay more than $0.60/share, plus they want a 3x liquidation preference. They will still agree to increase the Option Pool by 1 million shares. The company has no alternatives available to it, so it has to agree. This is called a "Down Round".

25 This is probably an unrealistic scenario – the company is much more likely to receive the $1 million in the next round to see if it can catch up, and then to get the $10 million in a subsequent round if it does. I assume it all comes in in one round to provide more of an "apples-to-apples" comparison and to magnify the impacts.

The Cap Table after the Down Round Series B is shown in Table 21:

Table 21 Cap Table After A Down Round Series B

Price per Share	**$0.60**							
	Shares				**Raised**	**%**		**Value**
	Common		**Series A**	**Series B**		**I&O**	**FD**	
	Shares	**Options**						
Professor	**500'000**					**2.2%**	**2.0%**	**$300'000**
Postdoc A	**250'000**					**1.1%**	**1.0%**	**$150'000**
Postdoc B	**250'000**					**1.1%**	**1.0%**	**$150'000**
University	**500'000**					**2.2%**	**2.0%**	**$300'000**
CEO	**1'000'000**					**4.3%**	**4.0%**	**$600'000**
Seed investors	**250'000**					**1.1%**	**1.0%**	**$150'000**
Management Pool		**2'000'000**					**8.0%**	**$1'200'000**
VC Fund A			**1'000'000**	**9'166'667**	**$ 5'500'000**	**44.0 %**	**40.5 %**	**$6'100'000**
VC Fund B			**1'000'000**	**9'166'667**	**$ 5'500'000**	**44.0 %**	**40.5 %**	**$6'100'000**
Total	**2'750'000**	**2'000'000**	**2'000'000**	**18'333'333**	**$ 11'000'000**	**100%**	**100%**	**$15'050'000**
Issued and outstanding	**23'083'333**							
Fully diluted	**25'083'333**							
Raised in this round	**$11'000'000**							
Cumulative raised	**$14'210'000**							
Pre-Money	**$4'050'000**							
Post-Money	**$15'050'000**							

The result is that the company has to issue over 18 million new shares and the university's share has gone down to 2.2% on an issued and outstanding basis and 2.0% on a fully diluted basis, versus 5.1% and 4.3% in the base case scenario, and the value of their holdings has gone down from $1 million in the original scenario to $300,000. The investors now own 88% of the company on an issued and outstanding basis and 81% on a fully diluted basis. Down rounds are why venture capitalists get called vulture capitalists.

5.11.1.9. IPO After A Down Round – The Reverse Split

Let's assume the company solves its R&D problems, successfully develops its lead product and starts sales. The investment bankers again feel they can take the company public and sell shares to individual investors. They want to price the shares at $8/share, but now feel that the company has too many shares outstanding – over 25 million, versus less than 13 million in the original scenario. They therefore tell the company that it is going to have to carry out a 1:2 Reverse Split – i.e., for every two old shares a shareholder owns, they'll receive one new share. They tell the company that if the company does this, they will be able to sell 8 million shares to the public at $8/share, just as in the original scenario. The company wants to go public so that the investors and management can achieve liquidity, so they have no choice but to agree.

The Cap Table after the IPO with Reverse Split is shown in

Table 22, together with a comparison with the outcome of the base case IPO.

Table 22: Cap Table After An IPO With Reverse Split

Price per Share	**$8.00**					
Reverse Split	**1 for 2**				**Original Scenario**	
	Shares Common Shares	**Raised**	**% I&O**	**Value**	**Value**	**Diff**
Professor	**250'000**		**1.2%**	**$2'000'000**	**$4'000'000**	**($2'000'000)**
Postdoc A	**125'000**		**0.6%**	**$1'000'000**	**$2'000'000**	**($1'000'000)**
Postdoc B	**125'000**		**0.6%**	**$1'000'000**	**$2'000'000**	**($1'000'000)**

University	250'000		1.2%	$2'000'000	$4'000'000	($2'000'000)
CEO	500'000		2.4%	$4'000'000	$8'000'000	($4'000'000)
Seed investors	125'000		0.6%	$1'000'000	$2'000'000	($1'000'000)
Management Pool	1'000'000		4.9%	$8'000'000	$16'000'000	($8'000'000)
VC Fund A	5'083'333		24.7%	$40'666'667	$24'000'000	$16'666'667
VC Fund B	5'083'333		24.7%	$40'666'667	$24'000'000	$16'666'667
VC Fund C					$16'000'000	($16'000'000)
Public Investors	8'000'000	$64'000'000	38.9%	$64'000'000	$64'000'000	$0
Total	20'541'667	$64'000'000	100%	$164'333'333	$166'000'000	($1'666'667)
Issued and outstanding	20'541'667				20'750'000	($208'333)
Fully diluted	20'541'667				20'750'000	($208'333)
Raised in this round	$64'000'000				$ 64'000'000	$0
Cumulative raised	$78'210'000				$ 77'210'000	$1'000'000
Pre-Money	$100'333'333				$ 102'000'000	($1'666'667)
Post-Money	$164'333'333				$ 166'000'000	($1'666'667)

The university's shareholding is down to 1.2% vs. 2.5% in our base case scenario, and the value of its holding is down to $2 million versus $4 million in the base case.

5.11.1.10. Acquisition After A Down Round

Now let's look at what happens if the company is acquired after a down round rather than going public. The key difference between this and the previous acquisition case we looked at is that as part of the punitive Series B financing, when the share price dropped by 40% to $0.60 per share, rather than doubling to $2.00 per share, the investors also demanded and received a 3x liquidation preference. Since each venture fund invested $5.5 million in this round, they will each receive $16.5 million off the top of the acquisition proceeds, in addition to the 1x multiple of their $1 million investments in the Series A.

The Cap Table after the acquisition is shown in Table 23, together with a comparison with our acquisition base case.

Table 23 Cap Table After Acquisition Following A Down Round

Acquisition Price	$91'800'000												
Per share	$7.2												
Liquidation Preferences													
Series A	1	x	$ 1.00										
Series B	3	x	$ 0.60										
	Shares				%			Proceeds					
	Common		Series A	Series B	I&O	FD	Preferences	Balance	Total	Base Case	A	%	
	Shares	Options											
Professor A	500'000				2.2%	2.0%		$1'132'226	$1'132'226	$3'090'196	($1'957'970)	36.6%	
Postdoc B	250'000				1.1%	1.0%		$566'113	$566'113	$1'545'098	($978'985)	36.6%	
Postdoc C	250'000				1.1%	1.0%		$566'113	$566'113	$1'545'098	($978'985)	36.6%	
University	500'000				2.2%	2.0%		$1'132'226	$1'132'226	$3'090'196	($1'957'970)	36.6%	
CEO	1'000'000				4.3%	4.0%		$2'264'452	$2'264'452	$6'180'392	($3'915'940)	36.6%	
Seed investors	250'000				1.1%	1.0%		$566'113	$566'113	$1'545'098	($978'985)	36.6%	
Management Pool		2'000'000				8.0%		$4'528'904	$4'528'904	$12'360'784	($7'831'881)	36.6%	
VC Fund A			1'000'000	9'166'667	44.0%	40.5%	$17'500'000	$23'021'927	$40'521'927	$23'041'176	$17'480'750	175.9%	
VC Fund B			1'000'000	9'166'667	44.0%	40.5%	$17'500'000	$23'021'927	$40'521'927	$23'041'176	$17'480'750	175.9%	
VC Fund C										$16'360'784	($16'360'784)		
Total	2'750'000	2'000'000	2'000'000	18'333'333	100%	100%	$35'000'000	$56'800'000	$91'800'000	$91'800'000	$0	100.0%	
Issued and outstandin	23'083'333												
Fully diluted	25'083'333												

The result is a massive shift of the proceeds from the common shareholders to the preferred. The Founders receive less than a third of what they got in the base case, while the two venture funds receive double what they received in the base case (though, in fairness, they also each invested over 50% more -- $6.5 million each versus $4 million.) Did I already mention that down rounds are why venture capitalists are called vulture capitalists?

5.11.1.11. Anti-Dilution

One of the emotive issues that always comes up in negotiations of start-ups is that of anti-dilution. Everyone would like anti-dilution protection, but of course someone has to be diluted if new employees are to be hired or new investors brought into the company.

It's important to distinguish between two types of anti-dilution:

The anti-dilution included in preference terms to protect early investors against later down rounds; and

The anti-dilution equity ownership negotiating model frequently employed by universities.

5.11.1.11.1. Investor Protection Against Subsequent Down-Rounds

One of the preferences that will be in the terms of the Preferred Share investments will be anti-dilution protection. Anti-dilution protection comes in two flavors:

Full Ratchet anti-dilution protection; and
Weighted Average anti-dilution protection

The way these anti-dilution measures actually operate is that the conversion price of the preferred stock into common stock prior to an acquisition or IPO – which is normally set up as 1:1 – is adjusted to a lower figure. So if the anti-dilution mechanism lowered the conversion rate of a round to say 0.8:1, the preferred shareholder would get 25% more common shares than they would otherwise have done.

5.11.1.11.2. Full Ratchet anti-dilution protection

Full Ratchet anti-dilution protection is draconian and it should be fairly easy to negotiate it away. In Full Ratchet anti-dilution protection, the price of earlier purchased shares is adjusted down to the latest price, and the number of shares is increased to the number that the earlier round investment would have purchased at this lower price. In our case, the Series B was priced at

$0.60 per share, so the price of the Series A would be adjusted to convert at 0.60 shares per share of common stock. At a conversion ratio of 0.60 per share, venture fund A and B's original $1 million investments would each have been converted into 1,666,667 shares of stock, so an additional 666,667 shares would have been issued to both venture fund A and B.

Table 24 shows the Cap Table after a Down Round Series B with Full Ratchet Anti-dilution protection. The effect is to lower each common shareholders' ownership of the company by 10% (e.g., the professor goes from 2.2% to 2.0%), while venture fund A and B each increase 1%, from 44.0% to 44.4%.

Table 24 Cap Table After A Down Round Series B With Full Ratchet Anti-Dilution

Price per Share	$0.60							
	Shares				Raised	%		Value
	Common		Series A	Series B		I&O	FD	
	Shares	Options						
Professor	500'000					2.0%	1.9%	$300'000
Postdoc A	250'000					1.0%	0.9%	$150'000
Postdoc B	250'000					1.0%	0.9%	$150'000
University	500'000					2.0%	1.9%	$300'000
CEO	1'000'000					4.1%	3.8%	$600'000
Seed investors	250'000					1.0%	0.9%	$150'000
Management Pool		2'000'000					7.6%	$1'200'000
VC Fund A			1'666'667	9'166'667	$ 5'500'000	44.4%	41.0%	$6'500'000
VC Fund B			1'666'667	9'166'667	$ 5'500'000	44.4%	41.0%	$6'500'000
Total	2'750'000	2'000'000	3'333'334	18'333'333	$ 11'000'000	100%	100%	$15'850'000
Issued and outstanding	24'416'667							
Fully diluted	26'416'667							
Raised in this round	$11'000'000							
Cumulative raised	$14'210'000							
Pre-Money	$4'850'000							
Post-Money	$15'850'000							

5.11.1.11.3.Weighted Average Anti-Dilution Protection

Weighted Average anti-dilution protection is less punitive to common shareholders, and it adjusts the price of earlier purchasers at a higher price by weighting the decrease in price by the amount of money raised at the higher and lower prices.

So, in our example, the conversion price of the Series A shares would be multiplied by:

> Number of shares actually issued / Number of shares that would be issued at new lower price
>
> or
>
> (18,333,334+2,000,000) / (18,333,334+3,333,334)
>
> or 0.9385 shares per share of common stock

1,000,000 shares of preferred stock would convert into 1,065,557 shares at a conversion ratio of 0.941 to 1. Therefore 65,557 additional shares would be issued to each of venture funds A and B, a far cry from the 666,667 they would each receive under Full Ratchet anti-dilution.

There are actually two flavors of Weighted Average anti-dilution protection:

> Narrow-based; and
> Broad-based

The example above is Narrow-based, and only takes into account the preferred shares.

Broad-based Weighted Average anti-dilution protection also takes into account the common shares and options that have been issued/granted. So, in our case, the conversion ratio calculation would be:

(18,333,334+2,000,000+ 4,750,000) / (18,333,334+3,333,334+4,750,000)

or 0.9495 per share of common stock.

1,000,000 shares of preferred stock would convert into 1,053,519 shares at a conversion ratio of 0.941 to 1. Therefore 53,519 additional shares would be issued to each of venture funds A and B, 12,038 fewer than they would have received Narrow-based Weighted Average anti-dilution protection.

5.11.1.11.4. University Anti-dilution Negotiating Model

An alternative to the university being treated as a co-founder and receiving a significant equity stake – 20% in our base case, which is an approach universities frequently take – is to say: "I don't care how much of the company I own now, I care how much I own after serious investors have valued the company by investing in it, so give me 5% but keep me at 5% until (say) $5 million has been raised."

The advantages of this to the university are:

It sounds less to the other founders and so is an easier sell; and
The university doesn't have to worry about the company issuing additional Founders shares before investors come in and strictly limit the company's ability to issue additional shares.

Venture capitalists are familiar with these arrangements and as long as:

There is a clearly defined endpoint to the anti-dilution protection; and

The percentage ownership that is being protected is reasonable – e.g., 5% rather than 20% such provisions will not be a barrier to the company being able to raise capital.

Table 25 - Table 27 show what the Cap Table would look like through Series A if the University negotiated to receive 10% with anti-dilution protection on a Fully Diluted basis to $3 million raised excluding Seed Round.

Table 25 Cap Table After Founders' Round, 10% Anti-Dilution Till $3 Million Raised

Price per Share	**$1.00**			
	Shares	**Raised**	**%**	**Value**
Professor	**2'000**	**$2'000**	**22.5%**	**$2'000**
Postdoc A	**1'000**	**$1'000**	**11.3%**	**$1'000**
Postdoc B	**1'000**	**$1'000**	**11.3%**	**$1'000**
University	**885**	**$885**	**10.0%**	**$885**
CEO	**4'000**	**$4'000**	**45.0%**	**$4'000**
Total	**8'885**	**$8'885**	**100%**	**$8'885**
Issued and outstanding	**8'885**			
Fully diluted	**8'885**			
Raised in this round	**$8'885**			
Cumulative raised	**$8'885**			

The University would receive only 885 shares in the pre-Split Founders' Round, rather than the 2,000 shares in our base case.

Table 26 Cap Table After Seed Round, 10% Anti-Dilution Till $3 Million Raised

Price per Share	**$0.80**			
Split	**250**	**for 1**		
	Shares	**Raised**	**%**	**Value**
Professor	**500'000**		**20%**	**$400'000**
Postdoc A	**250'000**		**10%**	**$200'000**
Postdoc B	**250'000**		**10%**	**$200'000**
University	**221'250**		**8.9%**	**$198'600**
Anti-Dilution Shares	**27'000**	**$108**	**1.1%**	**$221'600**
CEO	**1'000'000**		**40%**	**$800'000**
Seed investors	**250'000**	**$200'000**	**10%**	**$200'000**
Total	**2'498'250**	**$200'108**	**100%**	**$2'220'200**
Issued and outstanding	**2'498'250**			
Fully diluted	**2'498'250**			
Raised in this round	**$200'108**			
Cumulative raised	**$208'993**			
Pre-Money	**$2'020'092**			
Post-Money	**$2'220'200**			

These would become 221,250 shares following the 250 for one split prior to the Seed Round, plus a further 27,000 shares would need to be issued to bring the University back up to 10% after the Seed Round.

Table 27 Cap Table After Series A Round, 10% Anti-Dilution Till $3 Million Raised

Price per Share	$1.00						
	Shares			Raised	%		Value
	Common		Series A		I&O	FD	
	Shares	Options					
Professor	500'000				8.4%	7.2%	$500'000
Postdoc A	250'000				4.2%	3.6%	$250'000
Postdoc B	250'000				4.2%	3.6%	$250'000
University	248'250				4.2%	3.6%	$693'250
Anti-Dilution Shares	445'000			$1'780	7.5%	6.4%	$695'000
CEO	1'000'000				16.8%	14.4%	$1'000'000
Seed investors	250'000				4.2%	3.6%	$250'000
Management Pool		1'000'000				14%	$1'000'000
VC Fund A			1'500'000	$1'500'000	25%	22%	$1'500'000
VC Fund B			1'500'000	$1'500'000	25%	22%	$1'500'000
Total	2'943'250	1'000'000	3'000'000	$3'001'780	100%	100%	$7'638'250
Issued and outstanding	5'943'250						
Fully diluted	6'943'250						

Raised in this round	**$3'001'780**
Cumulative raised	**$3'211'780**
Pre-Money	**$4'636'470**
Post-Money	**$7'638'250**

After the Series A, an additional 445,000 shares would need to be issued to bring the University back up to 10% on a Fully Diluted basis. At this point the anti-dilution protection is exhausted and the University will undergo the same dilution as other shareholders going forward.

The University therefore owns 693,250 shares, a 10% stake, after the Series A, versus 500,000 shares, a 7.4% stake, in our base case, and it's clear that 10% with anti-dilution protection to $3 million raised is worth considerably more than 20% of the Founders' Round.

Table 28 - Table 31 shows what the Cap Table would look like through Series B if the University instead negotiated to receive 5% with anti-dilution protection on a Fully Diluted basis through $5 million raised, excluding the Seed Round.

Table 28 Cap Table After Founders' Round, 5% Anti-Dilution Till $5 Million Raised

Price per Share	**$1.00**			
	Shares	**Raised**	**%**	**Value**
Professor	**2'000**	**$2'000**	**23.7%**	**$2'000**
Postdoc A	**1'000**	**$1'000**	**11.9%**	**$1'000**
Postdoc B	**1'000**	**$1'000**	**11.9%**	**$1'000**
University	**425**	**$425**	**5.0%**	**$425**
CEO	**4'000**	**$4'000**	**47.5%**	**$4'000**
Total	**8'425**	**$8'425**	**100%**	**$8'425**
Issued and outstanding	**8'425**			
Fully diluted	**8'425**			
Raised in this round	**$8'425**			
Cumulative raised	**$8'425**			

The University would only receive 425 shares in the pre-Split Founders' Round.

Table 29 Cap Table After Seed Round, 5% Anti-Dilution Till $5 Million Raised

Price per Share	**$0.80**			
Split	**250**	**for 1**		
	Shares	**Raised**	**%**	**Value**
Professor A	**500'000**		**21.1%**	**$400'000**
Postdoc B	**250'000**		**10.6%**	**$200'000**
Postdoc C	**250'000**		**10.6%**	**$200'000**
CEO	**1'000'000**		**42.2%**	**$800'000**
University	**106'250**		**4.5%**	**$93'800**
Anti-Dilution Shares	**11'000**	**$44**	**0.5%**	**$208'800**
Seed investors	**250'000**	**$200'000**	**10.6%**	**$200'000**
Total	**2'367'250**	**$200'044**	**100%**	**$2'102'600**
Issued and outstanding	**2'367'250**			
Fully diluted	**2'367'250**			
Raised in this round	**$200'044**			
Cumulative raised	**$208'929**			
Pre-Money	**$1'902'556**			
Post-Money	**$2'102'600**			

These would become 106,250 shares after the Split preceding the Seed Round, plus it would receive a further 11,000 shares to bring it back to 5% after the Seed Round.

Table 30 Cap Table After Series A Round, 5% Anti-Dilution Till $5 Million Raised

Price per Share	**$1.00**						
	Shares			**Raised**	**%**		**Value**
	Common		**Series A**		**I&O**	**FD**	
	Shares	**Options**					
Professor A	**500'000**				**9%**	**8%**	**$500'000**
Postdoc B	**250'000**				**4%**	**4%**	**$250'000**
Postdoc C	**250'000**				**4%**	**4%**	**$250'000**
CEO	**1'000'000**				**18%**	**15%**	**$1'000'000**
University	**117'250**				**2.1%**	**1.8%**	**$327'250**
Anti-Dilution Shares	**210'000**				**3.8%**	**3.2%**	**$460'000**
Seed investors	**250'000**				**4%**	**4%**	**$250'000**
Management Pool		**1'000'000**				**15%**	**$1'000'000**
VC Fund A			**1'500'000**	**$1'500'000**	**27%**	**23%**	**$1'500'000**
VC Fund B			**1'500'000**	**$1'500'000**	**27%**	**23%**	**$1'500'000**
Total	**2'577'250**	**1'000'000**	**3'000'000**	**$3'000'000**	**100%**	**100%**	**$7'037'250**
Issued and outstanding	**5'577'250**						
Fully diluted	**6'577'250**						
Raised in this round	**$3'000'000**						

Cumulative raised	**$3'210'000**
Pre-Money	**$4'037'250**
Post-Money	**$7'037'250**

The University would receive a further 210,000 shares to bring it back up to 5% after the Series A.

The $10 million raised in the Series B Round blows through the anti-dilution limit of $5 million, so to calculate how many shares the University should receive, we break the transaction down into two transactions – a $2 million investment to get to the $5 million anti-dilution limit and an $8 million investment to complete the round. Now, the Option Pool increases from 1,000,000 to 2,000,000 shares as part of the Series B Round, and the original agreement requires that the 5% be calculated on a Fully Diluted basis, so does the University get its 5% of the extra 1,000,000 shares in the Option Pool or not? This is a business issue, not a legal matter, and the University should specify in the term sheet that any increase in the Option Pool is considered to occur before the Preferred Shares are issued to remove any ambiguity on this issue.

Table 31 Cap Table After Series B Round, 5% Anti-Dilution Till $5 Million Raised

Price per Share	**$2.00**							
	Shares				**Raised**	**%**		**Value**
	Common		**Series A**	**Series B**		**I&O**	**FD**	
	Shares	**Options**						
Professor A	**500'000**					**4.7%**	**3.9%**	**$1'000'000**
Postdoc B	**250'000**					**2.3%**	**2.0%**	**$500'000**
Postdoc C	**250'000**					**2.3%**	**2.0%**	**$500'000**
CEO	**1'000'000**					**9.4%**	**7.9%**	**$2'000'000**
University	**327'250**					**3.1%**	**2.6%**	**$854'500**
Anti-Dilution Shares	**100'000**					**0.9%**	**0.8%**	**$700'000**
Seed investors	**250'000**					**2.3%**	**2.0%**	**$500'000**
Management Pool		**2'000'000**					**16%**	**$4'000'000**
VC Fund A			**1'500'000**	**1'500'000**	**$3'000'000**	**14%**	**12%**	**$3'000'000**
VC Fund B			**1'500'000**	**1'500'000**	**$3'000'000**	**14%**	**12%**	**$3'000'000**
VC Fund C				**2'000'000**	**$4'000'000**	**19%**	**16%**	**$4'000'000**

Total	**2'677'250**	**2'000'000**	**3'000'000**	**5'000'000**	**$10'000'000**	**72%**	**76%**	**$20'054'500**

Issued and outstanding	**10'677'250**
Fully diluted	**12'677'250**
Raised in this round	**$10'000'000**
Cumulative raised	**$10'210'000**
Pre-Money	**$10'054'500**
Post-Money	**$20'054'500**

In our case, I have assumed that the University did include this issue in the term sheet. Table 31shows the Cap Table after the complete Series B. The University receives an extra 100,000 shares to get it to 5% on a Fully Diluted basis after the Option Pool is increased and $2 million of Series B Preferred is issued. The remaining $8 million investment takes the University's ownership down to 3.4% on a Fully Diluted basis at the end of the Round.

Table 32 Comparison Of University Negotiating Approaches

	Negotiating Model		
Shares held by Univ after		**Anti-Dilution**	
	20%	**10%/$3 mm**	**5%/$5mm**
Founders	**2'000**	**885**	**425**
Seed	**500'000**	**248'250**	**117'250**
Series A	**500'000**	**693'250**	**327'250**
Series B	**500'000**	**693'250**	**427'250**

Table 18 shows how the three approaches compare. Although the initial ownership percentages sound very different – 20%, 10% and 5% -- the end results are not that different. 10% protected to $2 million results in the University ultimately owning almost 40% more shares than in the case of an unprotected 20%, while 5% protected to $5 million results in an ownership that is only 15% less than an unprotected 20%.

5% protected until $5 million has been raised from investors (excluding grants) is a very common negotiating basis for the stake a university will receive in a start-up company.

5.11.2. Benefits And Limitations Of An Equity-Based Valuation

Benefits	Limitations
• Allows licensee to maximize funds available to develop technology	• Stock received will be illiquid for many years
• Can result in considerable upside	• Equity ownership by the university and the professor can result in conflict-of-interest issues

6. Conclusion

We have covered a lot of ground in this book. Some of the techniques we have looked at are highly quantitative, while others are much more relational. Some are highly labor intensive while others are not. All will give you a valid basis to propose and negotiate license terms with sophisticated companies, entrepreneurs and investors.

We have looked at a lot of examples and I have tried to include as much of my "hands on" learning from more than twenty years negotiating licenses to early stage technologies and from the stories of the successes and failures of others I have been told over the years.

Some of my key take aways and some important negotiating principles to bear in mind are:

Always have a basis for your valuation proposals;

Risk and value are inversely related – when risk is highest in the early stages of a technology's development, the technology's value will be low;

Focus your negotiations on the late stage terms, when value will be highest;

Maintain momentum in negotiations – don't let negotiations bog down because you're unsure whether to accept a proposal or not;

If you later realize you made a mistake, the basic mantra of licensing is "A deal is a deal" and you won't be able to change the deal and correct the mistake until the counterparty needs to change something. Most deals do need to be renegotiated at some point, particularly deals for very early stage technologies;

Each new negotiation starts with a clean sheet of paper; learn from your mistakes and apply the lessons learned in your next negotiation.

Good luck.

[End of document]