4 Nanomyths

and

3 Nanotruths

or

A Brief Introduction to the Paradoxes of Nanobusiness

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The myths

Nanomyth 1:

There is a “nanotech bubble”

Nanomyth 2:

No one’s making money from nanotech

Nanomyth 3:

Nanotech companies will be valued like IT and software companies

Nanomyth 4:

There is a nanotechnology market

Received wisdom

Received wisdom

Some basics

Total public pure plays **12**

Total number of small private "nanotech" companies in US **~670**

Total receiving VC $ 74

114 individual deals since 1998

$960.83 million (avg. ~$13M / company)

For comparison

Year	# of Deals	Total $M Invested
1998	3691	21244.29
1999	5604	54350.59
2000	8068	105904.4
2001	4609	40693.76
2002	3033	21309.08
2003	2779	18352.14
	27784	$261,854.2

Nano represents 0.4% of VC funding since 1998

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Nanomyth 1: The Nanotech Bubble

- "Bubble" requires
  - Investment opportunities
  - Investors

Where are they?

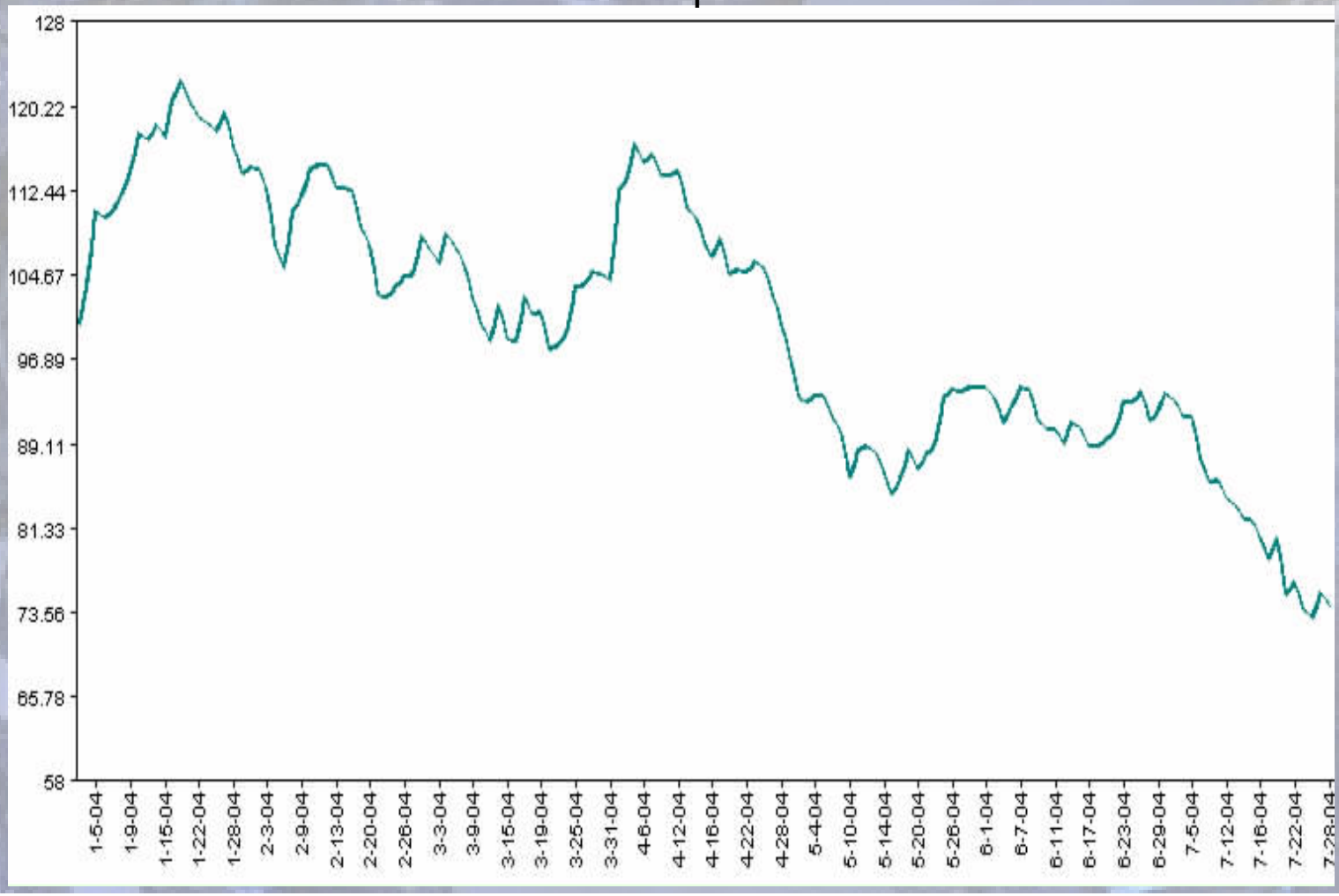
Merrill Lynch Nanotech Index (NNZ)

Index is not a tradable product

- Altair
- Amcol Intl
- Biosante Pharma
- Cabot CBT
- Combimatrix
- FEI Company
- Flamel Technol
- Harris & Harris
- Headwaters
- JMAR Tech
- M T S Systems
- Nanogen
- Nanophase Tech
- Novavax
- NVE
- Pharmacopeia
- Skyepharma
- Symyx
- Tegal
- Ultratech
- Veeco Instr
- Westaim

Punk Zeigel Nanotechnology Index

Index is not a tradable product



Veeco

Symyx

SkyePharma

FEI

Flamel Technologies

Pharmacopeia

Nano-Proprietary, Inc

Nanogen

Harris & Harris Group

NVE Corporation

Nanophase

Altair Nanotechnologies

JMAR Technologies

BioSante

MFIC CORP

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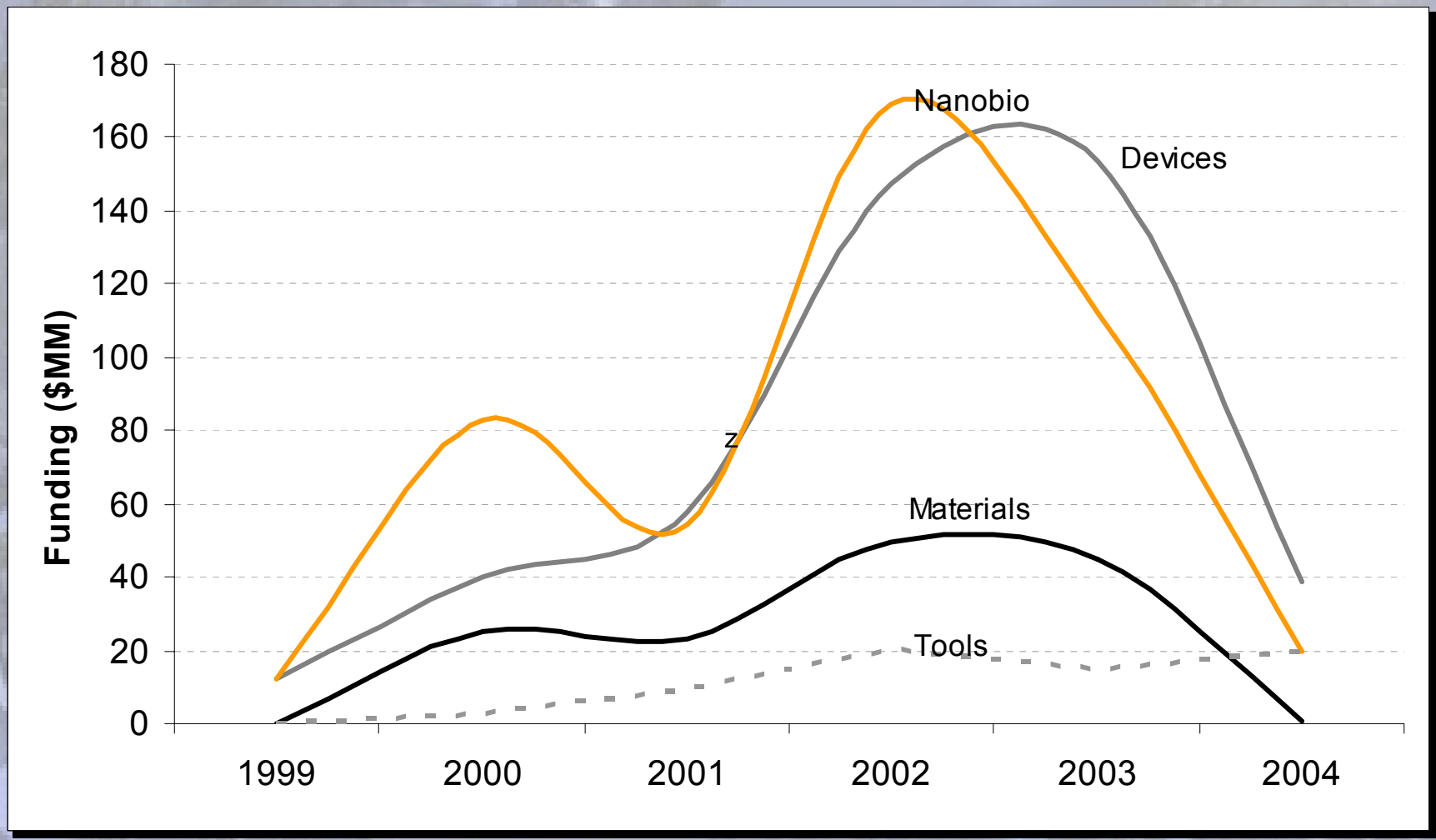
- Venture capital investment, 1999-2004



Nanomyth 2: No $ in Nano

- Established applications already in the billions that don't represent any new innovation
  - nano-TiO2 ($ market)
  - carbon black ($5 billion market)
  - 90nm semiconductors ($ market)

- Any market estimate is useless unless its *established* and *emerging* components are teased apart.

The upshot

- While these *established* applications will continue to dominate overall market size for the next ten years, *emerging* applications will dominate *growth* with a triple-digit CAGR and account for the majority of gross profits generated by nanotechnology.

Nanomyth 3: Nanotech cos will be valued like IT & software cos

- IT / software cos: typically 10x-100x valuations

- *NOT NANO*

  Commodity materials purchased on price and availability (i.e. most nanomaterials -- CNTs, dendrimers, etc.), once performance and reliability characteristics are established for >1 supplier,

  Near-term nanomarkets will resemble commodity markets for pork bellies: 1x-3x valuations

Nanomyth 4: There is a nanotech market

- Media and market analysts tend to refer to nanotechnology as a single, cohesive market and establish its "size" by
  1. Adding up "shipments" (CNTs in a box)

     or
  2. Add up end product sales (the whole car)

Neither produces market numbers that can be reconciled to GDP or to SIC codes, and therefore are of little strategic value

Good numbers?

- Cientifica: counted up the shipments of all 44 global nanotube suppliers
- Business Communications Company: 150 interviews to count up nanomaterials shipments (most of which, BTW, are not new but produced using established top-down techniques)
- Freedonia: 180-some individual nanomaterials suppliers

New model: Nanotech value chain

Nanomaterials

Nanoscale structures in pure form

1) Particles/powders
2) Nanofilms
3) Nanoporous materials
4) Nanotubes
5) Quantum dots
6) Dendrimers
7) Other (wires, rods, horns, belts…)

Nanoenablers

Nanomaterials processed into components or sub-assemblies

1) Polymer composites
2) Solar cells
3) Memory cells
4) Disk drive assemblies
5) Drug delivery carriers
6) Biological labels
7) Biomagnetic separations media
8) MRI/other imaging contrast media
9) Orthopedic materials
10) Slurries
11) Coatings
12) Lubricants
13) Nanostructured metal (steel, aluminum)
14) Display assemblies
15) Sensors
16) Catalysts
17) Additives
18) Filters
19) Phosphors
20) Magnetic fluid seals
21) Optical fibers (?)
22) Ceramic membranes
23) Propellants and explosives
24) Structural ceramics (?)
25) Nanocable assemblies

Nano-enabled products

Final products incorporating nanomaterials or nanoenablers

Too many to list in…

- Manufacturing
- Electronics
- Life sciences

the 3 truths

- Nanotruth 1: Nanotechnologies represent a new value chain framework of *nanomaterials*, *nanoenablers*, and *nano-enabled products* – each with its own characteristics and market dynamics: only the nano-enabled products category captures a GDP-style measure
- Nanotruth 2: There is an analytical axis of *established* versus *emerging* (disruptive) applications – both are valid measures, but must be separated and market value apportioned appropriately
- Nanotruth 3: There is an emerging "nanotechnology economy"-- as nanotech penetrates key markets there will be a ripple effect across industrial sectors – requires extrapolation of total economic impact of nanotechnology based on good market forecast numbers

The big questions, part 1

- How big is the market for *nanomaterials* versus *nanoenablers* versus *nano-enabled products*? How do these markets interrelate – which drives which and over what time period? (*And where does your nano-breakthrough fit in?*)
- What portion of market value is attributable to *established* products and methods of production versus *emerging*, disruptive alternatives? How will this change over time?
- Where are the profits – which segments have high, defensible gross margins and which are ruled by ruthless commodity economics?

The big questions, part 2

- How does the market size break down by industry grouping (manufacturing versus electronics versus life sciences) and by geography (US, Europe, Asia, ROW)?
- Are these numbers big or small relative to the big picture of spending and output in affected industries?
- What will be the broader economic impact of these numbers (i.e. total value created)?

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