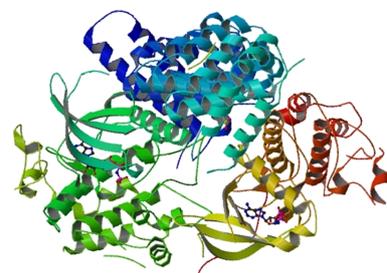
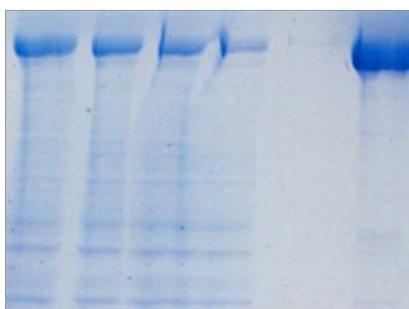
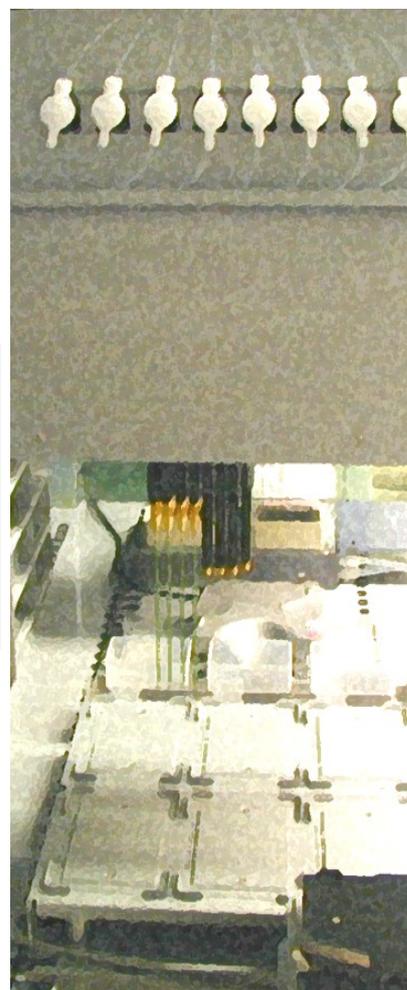


# ACEMBL

Leading Platform Technology for  
**Multi-Protein** Complex Production

## **MULTIBAC**<sup>TURBO</sup>

For Protein Expression in Insect Cells



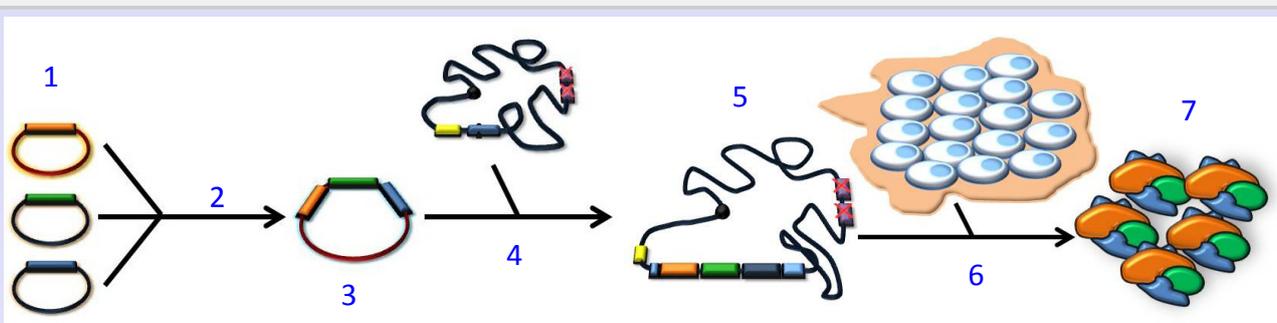
## The ACEMBL *MultiBac<sup>Turbo</sup>* System

Some proteins exist only in low amounts in their native cells. This makes heterologous expression of these proteins or of multi-protein complexes a prerequisite for an in-depth analysis of their structure<sup>1,2</sup> or function, in bioengineering<sup>3</sup>, vaccine production<sup>4,5</sup> or for other purposes<sup>6</sup>.

Sequential and/or parallel functional interactions between proteins, e.g. in known or designed biochemical or signaling pathways can be modeled and optimized *in silico* for purposes such as bio-remediation<sup>7</sup>, the synthesis of artificial compounds<sup>8</sup> or other applications, but a model's validity also requires functional *in vivo* tests to better understand the modeled and real pathway.

Baculoviral expression systems are a popular option for expressing eukaryotic proteins: easy handling, lack of safety concerns and almost genuine post-translational modification of mammalian proteins make insect cells a favorable production system.

While multi-protein expression remains a formidable task and generating sufficiently soluble protein complexes at times requires some tweaking, such challenges now become easier with *MultiBac<sup>Turbo</sup>*, a versatile and convenient Acceptor-Donor vector system for manual or automated recombineering of genes targeted for transfer into baculovirus and subsequent protein expression in insect cells.

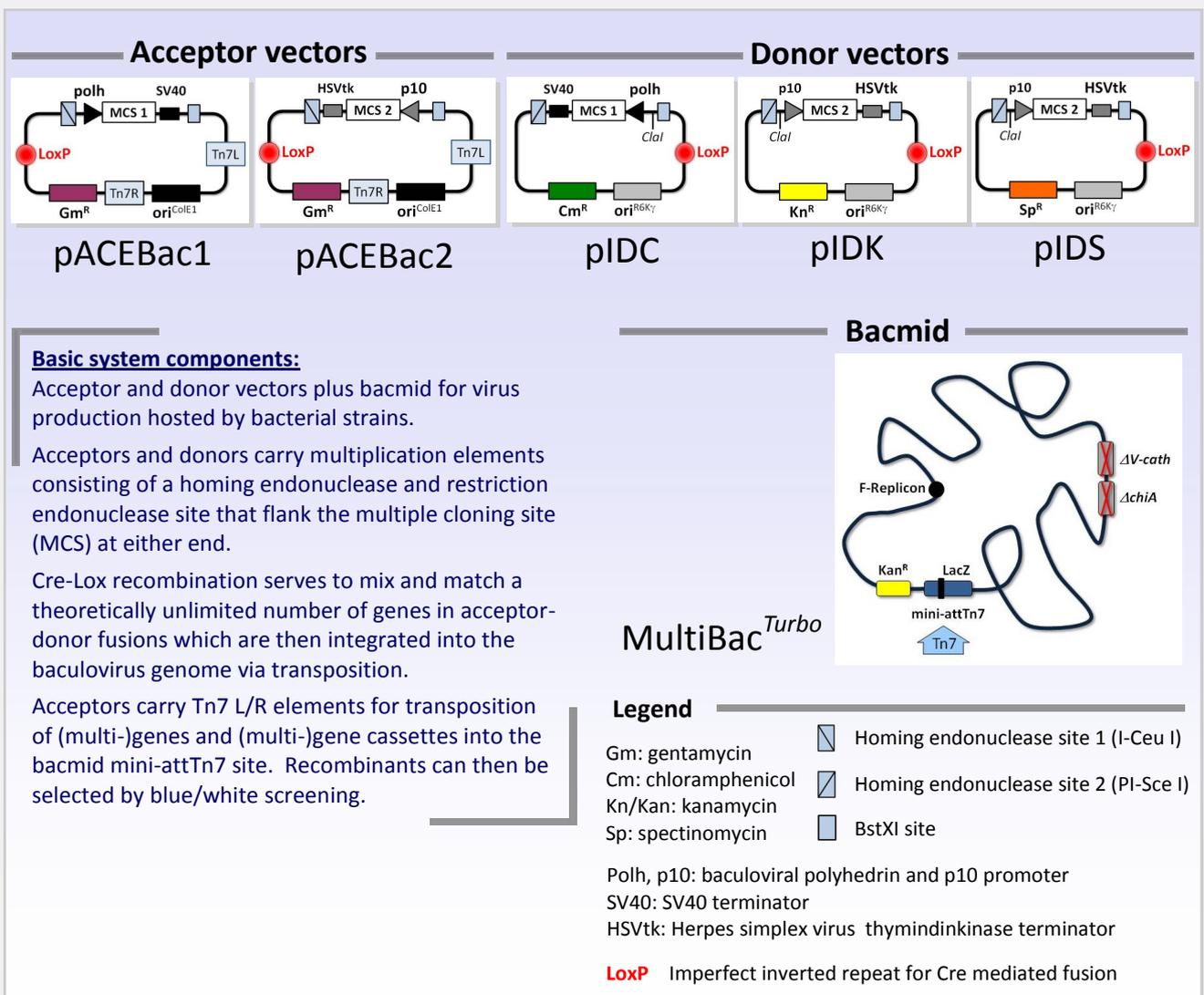


### How *MultiBac<sup>Turbo</sup>* works:

1. Design and clone your gene(s) of interest (GOIs) into **acceptor** and donor vectors
2. Match and mix your GOIs and then (re)combine them into **one** construct
3. Select and amplify your construct
4. Transfer the entire GOIs-assembly into your target bacmid
5. Select and amplify the „transgenic“ bacmid
6. Transfect insect cells and
7. Express your protein or protein complex of choice

## MultiBac<sup>Turbo</sup>

- consists of two **acceptor** and three **donor vectors** for manipulation of DNA in *E. coli* plus a bacmid for transfer of your final construct(s) into baculoviruses and subsequent transfection of your insect cells of choice.
- vectors possess features that allow you to flexibly insert and recombine your gene(s) of interest into (multi-) gene expression cassettes before assembling your final construct in *E. coli*.
- comes with bacterial strains for propagation of the donor vectors and acceptor-donor fusions; separate strains carrying bacmids for transfection of insect cells are supplied
- Replacement of non-essential genes *v-cath* and *chiA* in MultiBac<sup>Turbo</sup> bacmid (see figure below) improves protein production and reduces protein degradation.

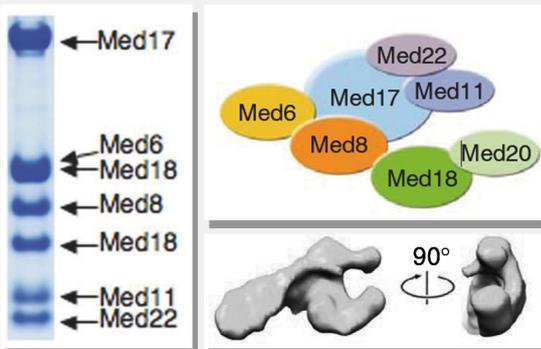


## Advantages of *MultiBac<sup>Turbo</sup>*

- **express single or multiple proteins** simultaneously
- **assemble multi-gene cassettes** easily and rapidly
- generate and test **gene variants** or **mutants** rapidly and in parallel to **speed up** and quickly **fine-tune/adapt** your gene expression project
- **fuse** single or multigene acceptor and donor plasmids via **Cre recombination**
- Easy **blue/white** screening for recombinant bacmids
- no plaque purification necessary, zero background
- improve **complex stability and solubility** through co-expression of partnering proteins
- **automate** your entire multigene expression vector production process for high throughput and scale-up

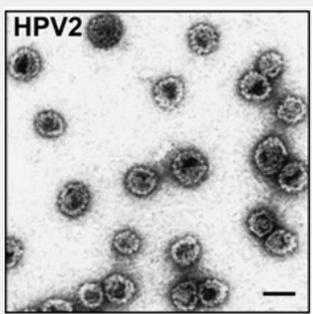
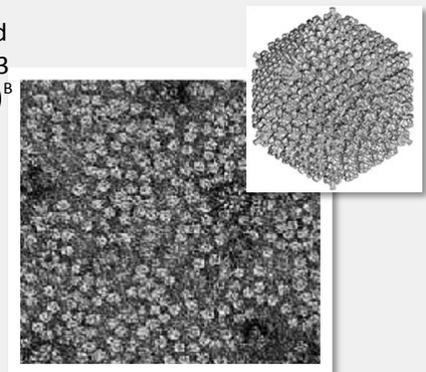
## What *MultiBac<sup>Turbo</sup>* could do for you

These are some examples of proteins and protein complexes that have been successfully expressed using this baculoviral expression vector system.

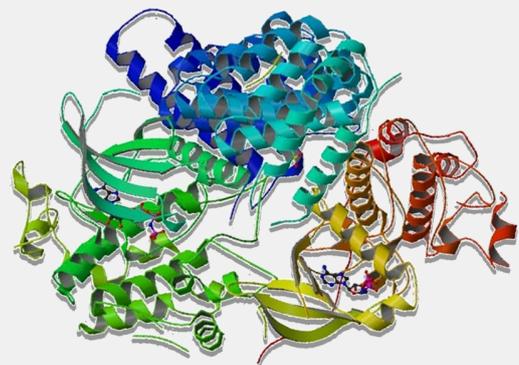


Subunit expression and molecular organization of the mediator head domain transcription complex, a regulator of eukaryotic RNA polymerase II<sup>A</sup>

Electron micrograph and model of adenovirus Ad3 virus-like particles (VLPs)<sup>B</sup>



Electron-microscopic image of papilloma serotype virus-like particles (VLPs) used in vaccine development<sup>C</sup>



Crystal structure of the trimeric LKB1-STRAD $\alpha$ -MO25 $\alpha$  tumor suppressor kinase complex<sup>D</sup>

*MultiBac<sup>Turbo</sup>* represents the baculoviral system in ATG's proprietary ACEMBL line of (multi-) protein expression tools.

## Testimonials

Don't just take our word for it, listen to what scientists think.

The *MultiBac<sup>Turbo</sup>* technology is the culmination of our many years of R&D at some of Europe's top research institutions. It is certainly the method of choice for enabling our research on eukaryotic multiprotein complexes.

*Dr. Imre Berger, Group Leader, Structural Complexomics, EMBL Grenoble*

Baculovirus is now used to produce a wide range of biologics and analytical proteins and is emerging as an incredibly influential technology in the pharmaceutical and biotech industries. *MultiBac<sup>Turbo</sup>* is probably the most advanced baculovirus technology available today.

*Dr. Daniel Fitzgerald, Blueshift Pharma Zurich; winner of Swiss Venture Award 2006 & 2010, DeVigier Entrepreneur Awardee 2007*

Our experiments went really well and I got good expression of both of my proteins. They are secreted and in all test purifications using the His-Tag they were purified as complexes.

*Lab Scientist, Sanofi-Aventis*

We anticipate that use of the MultiBac expression system will facilitate capsid production for papillomaviruses and thereby enable the generation of vaccines against infections by many of the as yet untargeted HPV types.

*Dr. Martin Müller, German Cancer Research Center (DKFZ), Heidelberg*

Dr. Berger's baculovirus technology for protein complex production is extremely powerful.

*Dr. Klaus Scheffzek, Group Leader, EMBL Heidelberg*

Robustness and versatility of the system was absolutely essential to produce high quality protein complex samples that can be crystallized. This had been virtually impossible to achieve by conventional co-infection methods.

*Prof. Yuichiro Takagi, Indiana University School of Medicine, USA*

This baculovirus system made complex expression a snap!

*Dr. Francisco J. Fernandez, CIB-CSIC, Madrid, Spain*

## Relevant publications

Bieniossek C et al. (2008). MultiBac: Multigene Baculovirus-Based Eukaryotic Protein Complex Production. *Current Protocols in Protein Science* 51: 5.20.1-26

Bieniossek C, Berger I (2009). Towards eukaryotic structural complexomics. *Journal of Structural and Functional Genomics* 10: 37-46.

Trowitzsch S et al. (2010). New baculoviral expression tools for recombinant protein complex production. *Journal of Structural Biology*, epub 21 Feb 2010, doi: 10.1016/j.jsb.2010.02.010

## Cited references

1) Fitzgerald et al., 2007, *Structure* 15: 275ff. | 2) Liu et al., 2004, *Nature* 428: 287ff. | 3) Patnaik, 2008, *Biotechnol Progress* 24: 38ff. | 4) Cox, 2008, *Curr Opin Mol Ther* 10: 56ff. | 5) Senger et al., 2009, *Virology* 388: 344ff. | 6) Cronin et al., 2007, *Protein Sci* 16: 2023ff. | 7) Finley et al., 2010, *BMC Systems Biol* 4:7 | 8) Stack et al., 2007, *Microbiol* 153: 1297ff. |

## Image references

A) Images courtesy of Prof. Yuichiro Takagi, Indiana Univ. School of Medicine | B) Image courtesy of Dr. Guy Schoen, IBS Grenoble | C) Images courtesy of Dr. Martin Müller, DKFZ Heidelberg | D) Image courtesy of Dr. I. Berger, modified from Zaqiraj et al., 2009, *Science* 326: 1707ff., doi: 10.2210/pdb2wtk/pdb | Inset images p.5: courtesy Dr. I. Berger and Prof. K. Scheffzek, Zaqiraj et al., 2009, doi: 10.2210/pdb2wtk/pdb

## Put your research in 5th gear!

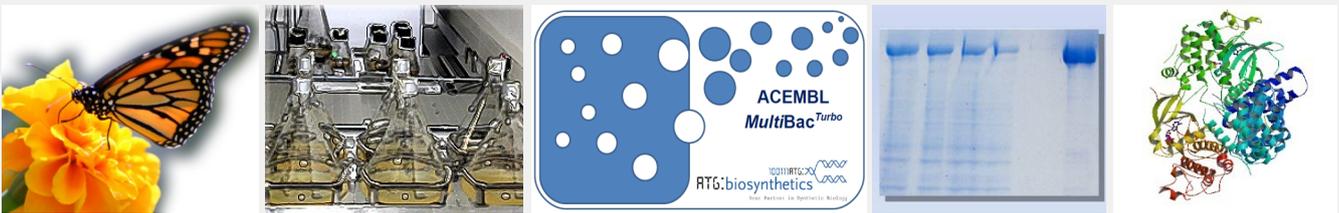
IF

- speed and performance matter in your research
  - you want an easy-to-handle system
- you want maximum flexibility in mixing and matching genes
  - you want first-class expression results
- you intend to automatize and scale-up your entire protein expression processes

THEN

the *MultiBac<sup>Turbo</sup>* System is what you need.

Get the expression results you are looking for!



Order online, via fax or telephone or have a company representative call you back for more information and to discuss our additional products and services, e.g.

- our gene synthesis service
- our proprietary codon and gene expression optimization service (*evoMAG*)
- optimizing gene assemblies for cloning (*evoMAG*)
- conceptualizing and planning complex projects

For more details on additional services please inquire about our separate brochures or go to our webpage.

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