



# Cypro

The program for the preparation of cytostatic drugs.

 CIS *healthcare*

## Cytostatic drug-preparation using Cypro

**CIS healthcare Deutschland GmbH** distributes and programmes the cytostatic drug preparation software **Cypro**. **Cypro** was the first **gravimetric preparation** program to be used in pharmacy practice. But also the **volume-based** and **partly volume-based** preparation is no problem with **Cypro**. **Cypro** is employed in hospitals and also in public pharmacies, enabling doctors and pharmacists to work in conjunction.

## Quality improvements in oncology

The prescription and preparation of cytostatic drugs for parenteral application requires particular care. Owing to the toxicity of the treatment, **quality management** has always been a very important feature of oncology. **Quality improvements** are, therefore, an on-going requirement in the interest of the patient.

The **quality of the actual preparation** of cytostatic drugs ready for application has been greatly improved by the introduction of gravimetric, as opposed to volumetric preparation.

Only gravimetric preparation allows the pharmacist to supply a high quality preparation that exactly reflects the doctor's prescription.

The **Cypro** program, however, goes far beyond preparation control, not only supporting oncology pharmacists and doctors in their clinical work, but also providing them with **documentation and control mechanisms** throughout the course of treatment.

**Cypro**, therefore, offers both computer-controlled preparation and a **segment devoted to the patient and the treatment**. The recording of detailed patient data and clinical data relevant to the treatment together with full documentation of the preparation of the medication enables control and documentation throughout a patient's course of treatment.



## Functionality

### Network and multi-user capability

**Cypro** is a network-compatible program with a central SQL database which allows direct access to patient data and prescriptions both by the pharmacy and by the prescribing health care professional, thus supporting interdisciplinary collaboration and enabling the therapeutic team to access all treatment-related data at any time.

### Use of standard protocols

**Cypro** enables recording and validation not only of the actual cytostatic drugs, but also of the **entire treatment, including supportive drugs**.

In preparing the prescription, the prescriber can call up a treatment record from the protocol file. The standard treatment record can be altered to individual requirements, or a formulation can be entered independently of the format file.

The prescribing process is completed by entering the prescription date and treatment start date. A treatment protocol is automatically prepared and can be printed out and used to administer the medication. In addition to the cytostatic treatment, it may also contain details on support medication.

A formulation is only available for preparation in the pharmacy once a prescriber and a pharmacist have approved it. Authority to approve a prescription is linked to individual access authority through personal passwords, which replaces the traditional signature.

The use of standard formats, including treatment regimens, schedules and supportive medication, allows for documenting the standard treatment program of the hospital or medical practice site.

### Automatic calculation of correct quantity for the formulation

By using standard formats, the correct quantity is automatically calculated from the **patient's body size measurements** in accordance with the calculation basis chosen. Even for modified treatment formats (individual administration), **Cypro** calculates the individual dose of the various substances. This can be done on the basis of **body surface area** or **body weight**. In addition, the **target AUC** can be obtained. The required dose is then calculated by taking into account the estimated glomerular filtration rate. The dose can, of course, also be entered as an **absolute value**.

If the weight, body size, body surface area or glomerular filtration rate change, the correct quantity in the formulation is **automatically recalculated** in accordance with the calculation basis chosen. In this case, the validation check is disabled.

Changes in the patient's data, such as weight, body surface area, height, diagnosis and glomerular filtration rate are automatically recorded in a **Patient History section**.

## Recording of cumulative dose

By keeping a record of the cumulative dose (of the drug produced or from treatments at other practice sites), automatic warnings for necessary reductions in dosage or existing contra-indications are provided for medications for which the cumulative dose is relevant. **Cypro** also gives a warning if the dose is outside a pre-defined **maximum or minimum standard dose**.

## Print-out of cytostatic requirements

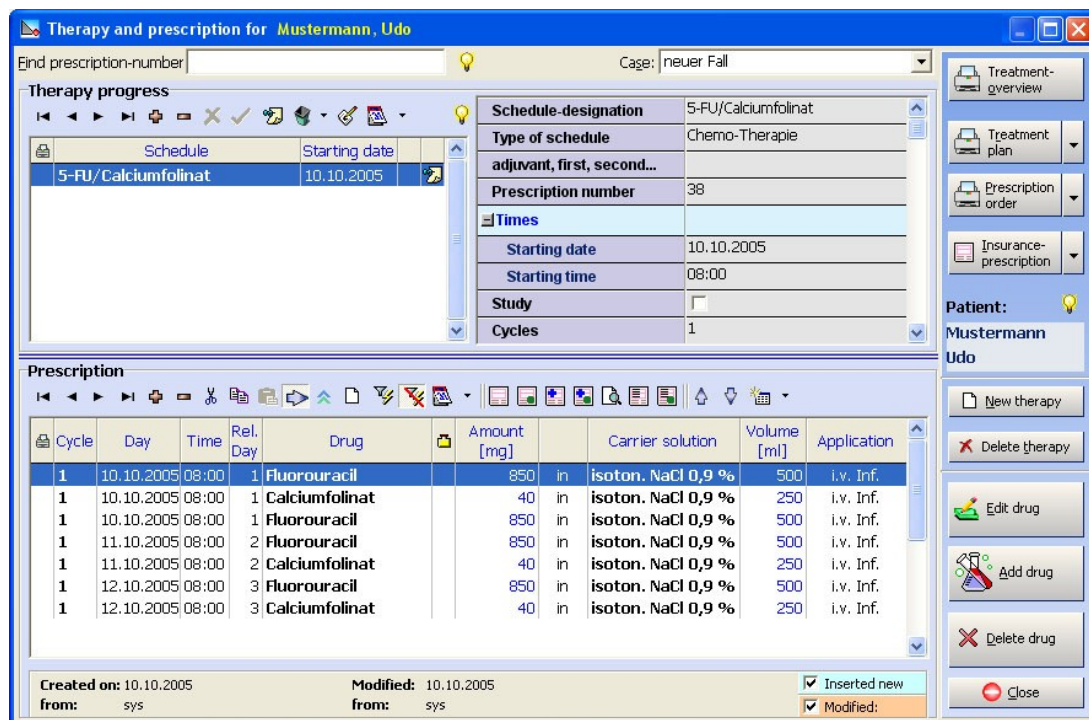
**Cypro** can print out cytostatic requirements which are based on an existing treatment format. In this case, the prescriber only has to give the quantity information. A blank requirements form can, of course, also be printed. Here both the drug and quantity information must be given.

## Preparation of production plans

The production plan contains the required quantity of active ingredient and the required amount of carrier solution and thus serves as a preliminary to the preparation of the required quantities.

## Global master data

All master data are administered globally and can be freely modified by authorized users.



The screenshot displays the 'Therapy and prescription for Mustermann, Udo' window. The 'Therapy progress' section shows a table with columns for 'Schedule', 'Starting date', and 'Starting time'. The 'Prescription' section contains a detailed table with columns for 'Cycle', 'Day', 'Time', 'Rel. Day', 'Drug', 'Amount [mg]', 'Carrier solution', 'Volume [ml]', and 'Application'.

Cycle	Day	Time	Rel. Day	Drug	Amount [mg]	Carrier solution	Volume [ml]	Application
1	10.10.2005	08:00	1	Fluorouracil	850	in isoton. NaCl 0,9 %	500	i.v. Inf.
1	10.10.2005	08:00	1	Calciumfolinat	40	in isoton. NaCl 0,9 %	250	i.v. Inf.
1	10.10.2005	08:00	1	Fluorouracil	850	in isoton. NaCl 0,9 %	500	i.v. Inf.
1	11.10.2005	08:00	2	Fluorouracil	850	in isoton. NaCl 0,9 %	500	i.v. Inf.
1	11.10.2005	08:00	2	Calciumfolinat	40	in isoton. NaCl 0,9 %	250	i.v. Inf.
1	12.10.2005	08:00	3	Fluorouracil	850	in isoton. NaCl 0,9 %	500	i.v. Inf.
1	12.10.2005	08:00	3	Calciumfolinat	40	in isoton. NaCl 0,9 %	250	i.v. Inf.

Metadata at the bottom of the window: Created on: 10.10.2005 from: sys; Modified: 10.10.2005 from: sys. Checkboxes for 'Inserted new' and 'Modified' are checked.

**Therapy plan of a patient**

## What does a Cypro system look like?

A Cypro System always comprises a **documentation station** for the input of patient and treatment information and a **preparation station** in a sterile area.

Patient and treatment data are entered at the **documentation station**, formulations are released for preparation, and the documentation can be further processed and analysed. The documentation station is linked via network to the preparation computer. It is, of course, possible to have several documentation stations and several preparation stations if there are several preparation workbenches. One documentation computer can also serve several preparation computers. All changes made at the documentation station are immediately visible at the preparation stations and vice versa. Hence, double-preparation can't occur. The central **Cypro database** can either be held on the documentation station computer or on a central server.

### Menu-guided preparation

The use of Cypro ensures consistency and high quality in the preparation of cytostatics – even with staff rotations.

Preparation can be carried out safely by pharmacy technicians, as Cypro provides complete documentation, and a uniform method of working is guaranteed.

The networking capability means that Cypro can be used simultaneously on several preparation stations. A formulation is available for preparation at any workstation, until it is selected and preparation commences.

A new type of program structure for gravimetric preparation minimises the number of computer-controlled steps and the time required, while maximising the safety of the preparation process.

Cypro offers three preparing kinds : **mass-orientated, volume-based and partly volume-based**. The preparing kind can be adjusted as default or individually per prescription.

The standard kind of preparing is the **mass-orientated preparation**. This offers in relation to all other preparing kinds a **maximum of quality and increased security** in cytostatic drugs preparation, since all working steps are weighed out and surveyed by Cypro.

With the **partly volume-based preparation** only not opened vials and the originated remainders are weighed out. The actual preparation takes place volume-based without scale control. However through the exactly remainder documentation the remainders can be used as with the mass-orientated preparation completely and safely up to the expiration of the stability.

The **volume-based preparation** completely works without weighing at the single working steps of the preparation process. A control by Cypro is possible thus only by establish the single working steps. But also with deviating vial volumes, Cypro guarantees here by correction options during the preparation process the correct documentation, also of the remainder vials.

The **preparation system** in the clean room consists for the **mass-orientated** and the **partly volume-based preparation** of a **computer** and monitor with the Cypro program, a **scale** and a **label printer**. The scale is located in the interior of the workbench, computer and label printer are located outside.

As monitor a TFT screen is used, in the case of work benches with a monitor window, installed behind the workbench. Otherwise special monitors can be positioned near or in the interior of the workbench. The label printer can be either a thermal direct or a thermal transfer printer.

Cypro provides maximum preparation safety because it weighs out the individual steps in the process. Preparation in the sterile area is controlled by a menu via the monitor and scale.

**Cypro** leads the production technician through all the steps and checks that they are performed correctly. This removes the need for a „**second pair of eyes**” and the supervisor is freed up to do other work

The preparation system in the clean room with the **volume-based preparation** is developed exactly the same as with the mass-orientated preparation, but without the scale.

Partly volume-base and volume-base preparation are, just as the mass-orientated, **menu-guided**, i.e. Cypro gives all working steps and indicates these on the monitor.



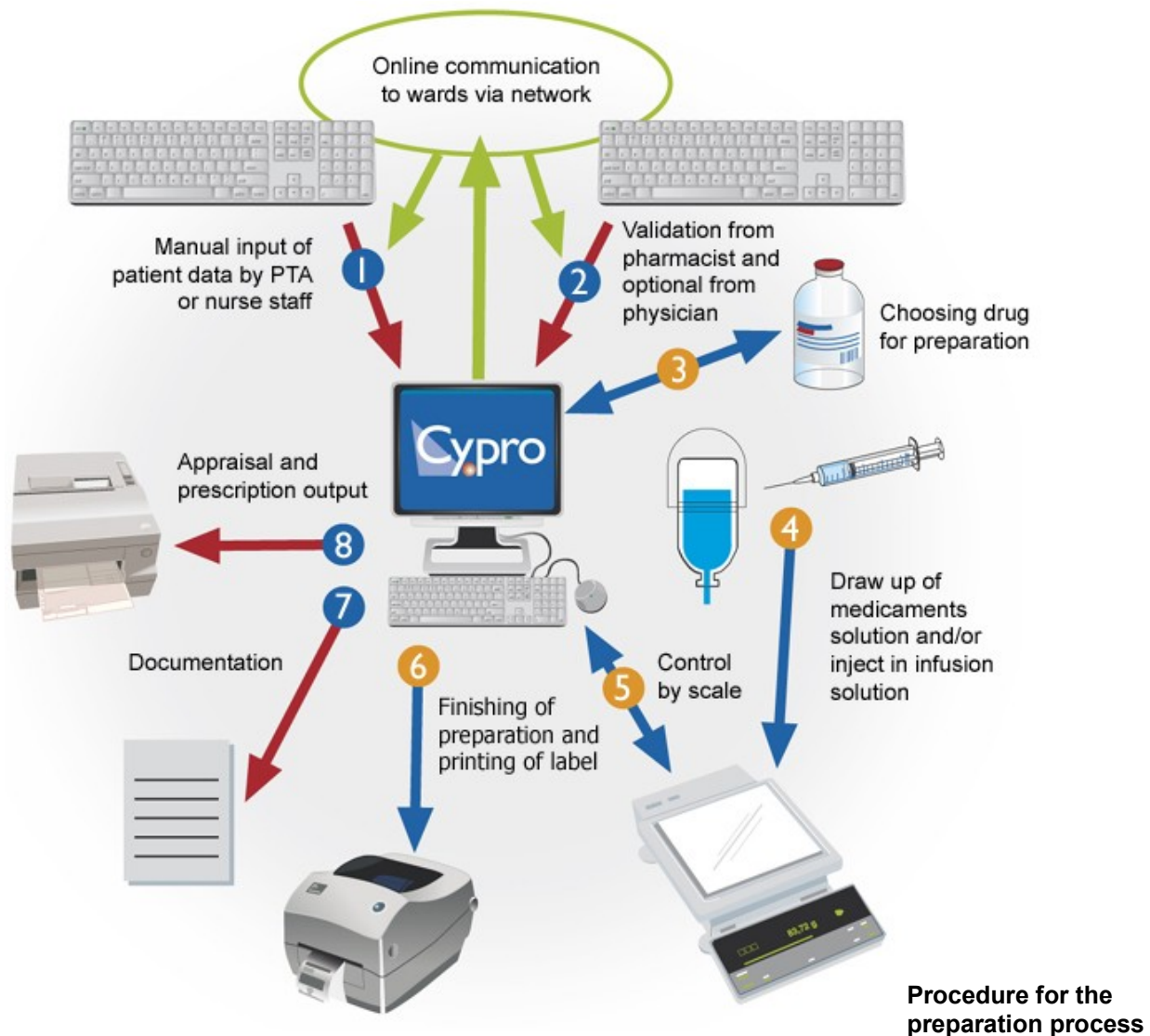
## Ensuring the stability of residual quantities and preparations

Opened bottles are marked and can be used for preparation until their expiration date. All bottles are used up efficiently.

**It is not possible to use a substance in preparation past their expiration date.**

## Automatic label printing

After preparation is complete, one or more labels are automatically printed. **Name** and details of the **active ingredient**, the **expiration date**, **storage instructions** and **warnings** are printed on the label. Cypro notes both the **correct quantity** and the **actual quantity** of active ingredient in the application-ready product.



## The mass orientated preparation process in detail

Cypro details all the individual process steps for preparation at the workbench. Cypro has a menu which leads the technician through the preparation process. The program monitor image is displayed on a TFT screen in the sterile area. A summary is also shown on the associated scale inside the workbench. All steps in the preparation process are weighed out. The technician communicates with the program via scale with a keyboard and thus confirms that the process steps have been performed. As the preparation process is controlled overall by the menu display on the scale, there is **no need for a control keyboard**. This, therefore, means that all the steps in the preparation process can be followed without leaving the workbench.



The individual steps in the preparation process are explained below using the example of an infusion solution and are illustrated by means of the **Cypro** menu displayed on the TFT monitor.

### Select a prescription

If the sterile area is set in preparation mode (generally this happens automatically when the user logs in), the prescription list is displayed first. This gives an overview of all prescriptions to be prepared. The preparation starts with selection of a particular prescription.



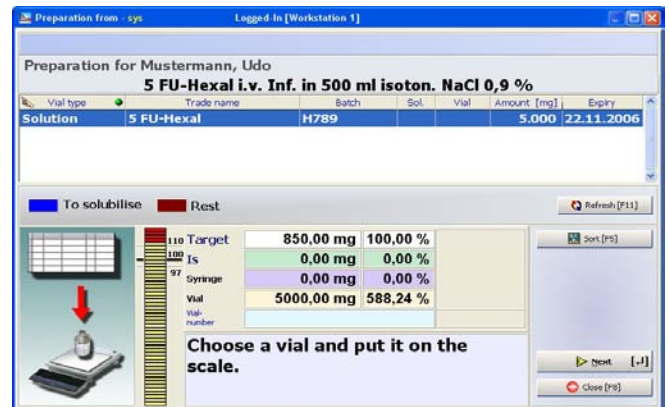
Preparation from - sys						
Logged In [Workstation 1]						
Prescription list				Preparation for today [F10]		Montag, 10. Oktober 2005
Preparation for Mustermann, Udo						
Presc.-No.	Time	Trade name	Amount [mg]	Status	Place	Pr.
38	08:00	5 FU-Hexal	850			●
38	08:00	Leucovorin	40			●
38	08:00	5 FU-Hexal	850			●

Patient	Mustermann, Udo	Rest-management [F2]	Print-outs [F6]
Birthday	01.01.1950	Prescription Day - [F3]	Onest [F7]
Visit-number		Prescription Day + [F4]	Reserve [F8]
Ward	New Ward	Sort [F5]	Annul the reservation [F9]
Application	i.v. Inf. in 500 ml isoton. NaCl 0,9 %	Refresh [F11]	More prescriptions [F12]
		Close	Preparation [-]

## Select a bottle

Once the prescription is selected, **Cypro** shows all unopened bottles in the system and all unexpired opened bottles containing the active ingredient in question. If the prescription explicitly refers to a trade name and not an active ingredient (e.g. in the case of trials), only bottles with this trade name are shown. Thus the use of other bottles is precluded.



The bottle to be used is selected from the list displayed via the menu on the scale or by **barcode** and placed on the scale. When the **ENTER** key on the scale is pressed, **Cypro** weighs the bottle and notes the weight.

A warning appears immediately if the wrong bottle is selected or the wrong quantity extracted. In this case, the technician has the option to revisit the process step in question.

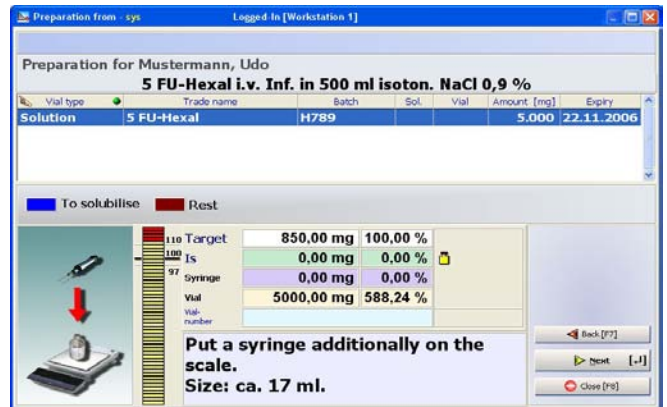
If a deviation of greater than three percent is identified, an error message appears and the opportunity is given to correct the error.

If the cytostatic chosen is a dry substance, **Cypro** asks for the corresponding weight of the solvent to be added. In order to simplify the preparation process, **Cypro** converts each **weight** to a **volume** and displays this for the technician. Once the solvent has been added, it is weighed again. In using the scale, the actual quantity of solvent added is used to calculate the active ingredient concentration. The dissolved substance is stored together with the active ingredient concentration under a **bottle number**. This allows the quantity of active ingredient extracted to be determined, if only part of the content is withdrawn.

In case of a cytostatic that does not dissolve easily, preparation can be interrupted and another prescription can be processed. Thus, several bottles can be dissolved in advance. If, after the addition of the solvent to the last bottle, the active ingredient in the first bottles is completely dissolved in the solvent, it is then possible to start the actual preparation process with respect of these bottles.

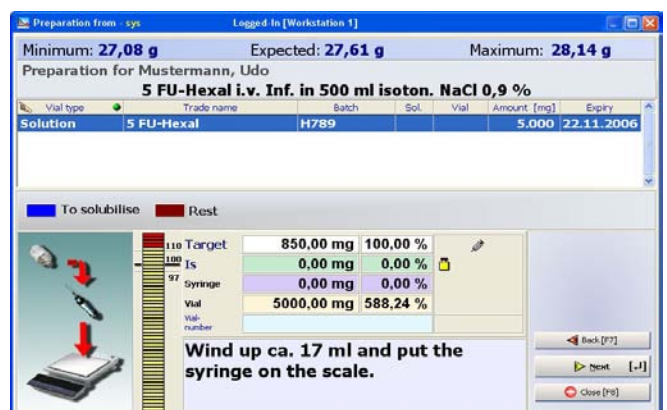
## Weigh empty syringe

Cypro now asks for an empty syringe to be placed on the scales alongside the bottles which have been weighed. The volume to be drawn into the syringe is displayed. Instead of using one large syringe, it is of course also possible to use several small ones and weigh them all together. When the **ENTER** key on the scale is pressed, **Cypro** weighs the bottle and empty syringe and notes the weight.



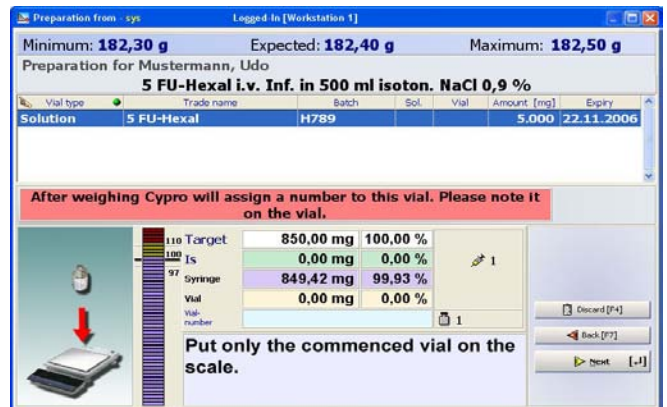
## Fill the syringe

**Cypro** now asks for the content of the bottle to be drawn up into the syringe. If only part of the content of the bottle is required, **Cypro** gives this volume in **ml**. The scale is used to check whether the quantity is correct. The filled syringe is placed on the scale alone and weighed by pressing the **ENTER** key on the scales.



## Weigh residual quantity

If only part of the content is withdrawn from the bottle, the remainder is left in it. **Cypro** now asks for this residual quantity to be weighed. Here the quantity of active ingredient still in the bottle, the expiration date and the storage conditions are recorded. An open bottle number is assigned, enabling the open bottle to be clearly identified for use in a future preparation process.

Preparation from - sys Logged in [Workstation 1]

Minimum: **182,30 g** Expected: **182,40 g** Maximum: **182,50 g**

Preparation for Mustermann, Udo

**5 FU-Hexal i.v. Inf. in 500 ml isoton. NaCl 0,9 %**

Vial type	Trade name	Batch	Sol.	Vial	Amount [mg]	Expiry
Solution	5 FU-Hexal	H789			5.000	22.11.2006

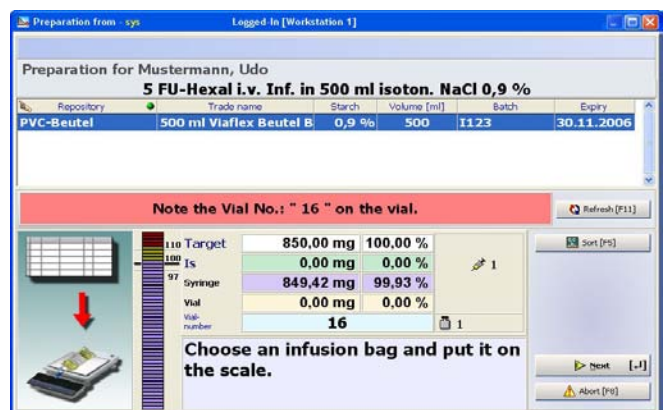
After weighing Cypro will assign a number to this vial. Please note it on the vial.

110 Target	850,00 mg	100,00 %		1
100 Is	0,00 mg	0,00 %		
97 Syringe	849,42 mg	99,93 %		
Vial	0,00 mg	0,00 %		
Vial number				1

Put only the commenced vial on the scale.

## Weigh infusion bag

**Cypro** now shows all infusion bags/infusion flasks or pumps which may be used (depending on the volume of carrier solution). The technician selects the infusion bag/infusion flask using the menu on the scale or by **barcode**, places it on the scale, and weighs it by pressing the **ENTER** key on the scale.

Preparation from - sys Logged in [Workstation 1]

Preparation for Mustermann, Udo

**5 FU-Hexal i.v. Inf. in 500 ml isoton. NaCl 0,9 %**

Repository	Trade name	Starch	Volume [ml]	Batch	Expiry
PVC-Beutel	500 ml Viaflex Beutel B	0,9 %	500	I123	30.11.2006

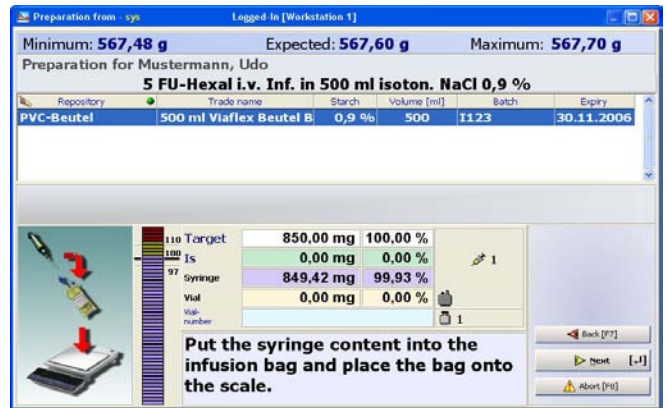
Note the Vial No.: " 16 " on the vial.

110 Target	850,00 mg	100,00 %		1
100 Is	0,00 mg	0,00 %		
97 Syringe	849,42 mg	99,93 %		
Vial	0,00 mg	0,00 %		
Vial number				16

Choose an infusion bag and put it on the scale.

## Inject the syringe content into the bag

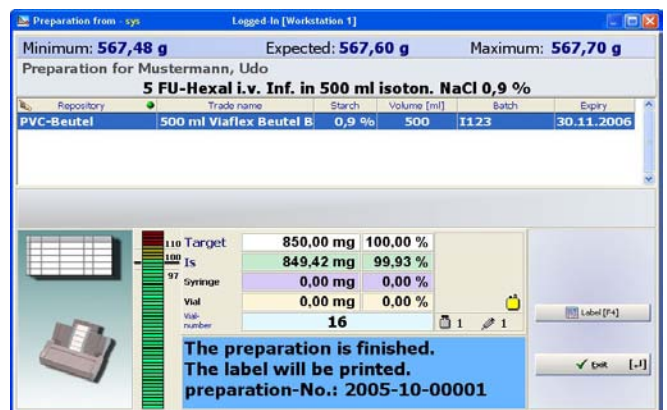
The syringe content is now injected into the infusion bag/infusion flask and weighed again.



**Cypro** does not assume that all the syringe content has gone into the bag, but measures the actual quantity in it. The bag/flask filled with the syringe content is placed on the scale and weighed by pressing the **ENTER** key on the scale.

## Print label

Each preparation process ends with the label. In addition to the quantity of active ingredient prescribed, this shows the **ACTUAL** quantity, the patient's name, date of birth, the date of preparation and application, and specific details on the expiration date depending on the container material, the concentration and the carrier solution.



A **preparation number**, by which each batch can be easily identified, is automatically assigned. An unintended interruption is also labelled and given a preparation number. The preparation documentation contains details of the prescription, the actual quantity of cytostatic and associated batch and the exact preparation time.

If large containers are used for economic reasons, the quantities which are inevitably left over are given a **residual quantity label** and also stored under a specific number.

The residual quantity label shows the quantity of cytostatic in each case and the expiry date of the residual quantity is printed automatically. Residual quantities can thus be used until the expiration date and their whereabouts can be tracked.

<b>C</b>	<b>Mustermann, Udo</b>
<b>Y</b>	Birthday : 01.01.1950 Ward : New Ward
<b>T</b>	
<b>O</b>	<b>5 FU-Hexal 850 mg (Fluorouracil)</b>
<b>S</b>	<b>i.v. Inf. in 500 ml isoton. NaCl 0,9 %</b>
<b>T</b>	Application : <b>Mo 10.10.2005</b>
<b>A</b>	Actual : 849,42 mg (Is-Diff.: -0,07 %)
<b>T</b>	2005-10-00001 - 10.10.2005
<b>I</b>	Storage : Durable till : <b>Do 13.10.2005 - 19:40 O'Clock</b>
<b>C</b>	<b>Test-Pharmacy</b>

## Documentation using Cypro

During preparation **Cypro** captures all parameters previously entered with respect to the patient and the formulation and stores additional batch data, such as the type and quantity of active ingredient, so that all preparation processes can be reconstructed at any time. The preparation documentation contains all data and quantities related to each preparation process, whereas the loss documentation serves to list the possible pharmacy staff exposure to cytostatics and thus forms the basis for further occupational health analysis.

## Freely configurable statistics

By capturing all preparation data and extensive information on patients and individual substances, Cypro allows to compile comprehensive statistics. The use of cytostatics can thus be reported by practice site or by prescriber, it can be checked whether residual quantities are being used, and an overview can be provided of the cost of a particular treatment program.

Freely configurable statistics can be compiled from all data captured by Cypro during preparation. For example, documentation can be produced by patient or by active ingredient. The statistics can be refined by specifying additional criteria. For example, information can be compiled for specific **active ingredients, practice sites clinics, prescribers, patients or batches**. The statistical analysis results can be exported to Microsoft EXCEL. They cannot only be used within the pharmacy, but can also be provided to other healthcare professionals as an additional service (**patient and preparation related statistics**).

## Benefits of Cypro

Cytostatics are prescribed to cancer patients throughout the world. These drugs act on tumour cells and prevent the cells dividing in the various growth phases. Because of their serious side effects, cytostatic doses must be prescribed individually. The optimal dosage of the active ingredient is determined specifically for each patient. Application-ready solutions can therefore not be made on an industrial scale, but have to be produced individually at specially equipped workstations in pharmacies

Standardisation in the prescription of oncology treatment and drug preparation is a major topic in both large and small preparation units.

Cypro works for the preparation of cytostatics according to standard in **mass-orientated** way.

This means that, after the prescription has been set up and checked using **Cypro** on the basis of a general prescription format taking into account individual patient parameters, preparation is controlled by a computer and a precision weighing scale.

In addition to the mass-oriented preparation Cypro supports also the **volume-based** and the **partly volume-based** preparation. All preparation kinds are menu-guided.

The program contains instructions which lead the technician through the steps to be followed in the preparation process, with the individual steps being controlled by the weighing scale and automatically documented. The technician can communicate with and control the computer via the display on the scale. This produces major gains in terms of **preparation quality** and **reduction in workload**. All the uncertainties associated with volumetric measurement are completely eliminated.

Moreover, there can be no possible confusion in practice between the individual bottles containing cytostatic solutions. Every residual quantity is precisely documented and available for subsequent preparation processes. This has shown to not only give technicians more confidence in their work, but it can also **save the pharmacy** up to 13% in preparation costs.

Directions are given for every step in the preparation process up to the label printing at the end, which means that, even with personnel rotations, consistency and high **quality standards** are maintained.

- **Preparation of cytostatics and supportive medication**
- **Mass-orientated, volume-based or partly volume-based preparation can be adjusted as default or individually per prescription**
- **Preparation security and quality improvements:**  
Cypro's **gravimetric basis** guarantees the **best possible quality** and enhanced security in the preparation of cytostatics. Uncertainties of measurement are excluded with the mass-orientated preparation. Only gravimetric preparation allows the pharmacist to supply a high quality preparation that exactly reflects the doctor's prescription.
- **Need for supervision eliminated:**  
With Cypro's check function at the mass-orientated preparation, there is no longer a need for the „second pair of eyes“ which otherwise serves to standardise preparation. One technician, rather than two pharmacists, can be entrusted with the preparation process and only a final check still needs to be performed by pharmacists, significantly reducing the demands on their time.
- **Cypro guarantees for the volume-based preparation by correction options the correct documentation of deviating vial volumes**

**For all preparation kinds Cypro guaranties:**

- **Menu-guided preparation:**  
Through screen-based instructions, Cypro guides the pharmacy technician through the preparation process and enables consistency to be maintained through the various steps, even with changes of personnel. Menu-guided preparation with standardised working steps substantially relieves the technician's workload.
- **Increased safety by using of barcodes:**  
Through using of barcodes for vial and infusion bag selection the preparation and documentation safety is increased once more.
- **Automatic documentation of bottles containing residual quantities:**  
Residual quantities can be safely used.
- It is not possible to use a substance in preparation that has passed its expiration date.
- **Every product is labelled:**  
The label states what is in the bag and not what it is supposed to contain.
- **No hand-written labels:**  
All labels are printed automatically.
- **No medication errors:**  
Before preparation it is checked whether the dosage amounts are current and whether they might have been recently amended (by the doctor calling up and reducing the dosage).
- **Parallel and uninterruptible working** for preparation and documentation can be done without problems.
- **Cost saving in the pharmacy, which constitute up to 13% of the costs of preparation**

■ **Comprehensive and free configurable documentation:**

By recording detailed patient data and clinical data related to the treatment regimen together with the complete medication program, it is possible to perform patient-related treatment progress checks and documentation. Integration of all treatment-related data ensures it together in this way, the quality of the whole prescription and treatment process and allows to optimize the **treatment strategy**.

The resulting transparency and objective documentation of the preparation process mean contributes to the delivery of a high quality end-product, namely the cytostatic solution.

■ **Complete process tracking with batch documentation:**

It is always known who has made what and when and what has been used when and in what quantity (batch documentation).

- Every step from the input of patient data, through the input of the prescription, to the preparation process documentation can be done electronically without the need for paper. The documentation can, of course, also be printed out if required, e.g. for statistics, preparation documentation, prescription lists.
- All data are stored in the Cypro database so that no paper or labels need to be kept as records, saving space, time and money.
- The entire preparation process including preparation (input of patient data and prescription), preparation, documentation and compilation of statistics is greatly simplified and accelerated.
- Complete patient administration
- Use of standard schedules
- Basic data of all medically relevant group of medicaments
- Mortality and side effect evaluation
- Clinical laboratory data
- Printings of German health insurance prescriptions with appraisal for billing to the health insurance companies
- Terminal Server- and CITRIX-Support
- HL7-Interface
- All sections of the hospital can be integrated by central and direct storage of the data in Cypro (online networking to the wards). Thus a direct input of the prescription orders is made possible on the part of the attending physicians

## Summary

The **Cypro** computer program offers a comprehensive approach to complete accompaniment to cytostatic treatment and preparation. The ability to combine patient records and configurable treatment formats with the possibility of calculating dosages and recording clinical parameters significantly reduces the workload on healthcare providers in oncology. Using the practice-proven modules of the Cypro program, the pharmacy can become the communications centre for oncology treatment.

In addition to preparing preparation data for case histories the oncology pharmacist is in a position to exchange all information with the clinical departments.

By linking all aspects of the treatment in this new way, the interdisciplinary oncology team can work together to maximise the quality and safety of the cytostatic treatment regimen. The **Cypro** computer program supports modern team-working and thus serves both the providers and the recipients of treatment.

By enabling individual characteristics to be investigated (maximum configurability), **Cypro** acts as an extension to the oncology team.

